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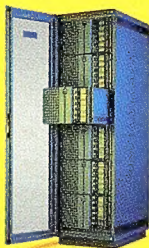
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CONNECTION

September 1998

The
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NetWare 5 is everything you love about NetWare—but better.

FEATURES

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By returning to the NetWare name, Novell underscores the return to its roots: networking technologies and the networks that these technologies have created. Find out how this refocus pays off with NetWare 5.

12 Installing NetWare 5 With a Graphical Utility

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20 Product Focus: Products That Support NetWare 5

If your company is upgrading to NetWare 5, you probably want to know which products support this new version of NetWare. Find out how Novell is working to ensure that your favorite applications will support NetWare 5, and read about some of the products that should soon be Novell Tested and Approved to work with NetWare 5.

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After your company upgrades to NetWare 5, will you migrate the network to pure IP? NetWare 5 offers several options to ease this

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46 Online Connection: A Brand New Car

Avoid pushy car salespeople and research your own car purchase on the Internet. From side-by-side comparisons to safety and recall notices, several web sites can provide you with all of the information you need to locate and purchase the car of your dreams. Or, if you would rather surf than drive, check out the new products, games, and network resources featured in this month's article.

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LETTERS TO THE EDITOR

Insecure FTP

I enjoyed your recent article "Enabling FTP Services for intraNetWare," (*NetWare Connection*, July 1998, pp. 25-31). I had to enable FTP on my company's network several months ago, and I could have used the article then. The article clarifies many vague points into a concise "do this."

Although I have read the article carefully, I think it neglects a vital point. FTP is a primitive protocol, even with a sophisticated front-end such as FTP Explorer. Using Novell's LANalyzer for Windows, I have confirmed that if you use FTP to log in to your company's network, NDS usernames and passwords are transmitted over the Internet in full text. FTP clients do not include encryption. Unless Novell's FTP client in LANwork Place Pro uses some encryption algorithm I don't know of (I haven't tested it), I would say that using FTP to access NDS is extremely ill advised. As a result, I have implemented very limited access with FTP on my corporate network.

T. Perrell

Thank you for the comments. Most Internet protocols do not use any form of encryption when sending usernames and passwords across the Internet. Similar security problems exist with Telnet (and thus with the XCONSOLE utility, which communicates with intraNetWare via Telnet). As a result, implementing intraNetWare's FTP services doesn't expose you to any more danger than you would have with an FTP server running on any other platform.

However, the intraNetWare FTP server could be a cause for concern if you store confidential information on your server. One possible solution would be to create new User objects for the users who need FTP access. You can then set separate access rights for FTP users and deny access to all regular users. You could also implement a policy requiring all FTP users to use different passwords for their regular NDS account and for FTP accounts.

An even better solution is just around the corner, however. With NetWare 5 you can create encrypted connections across the Internet. The new NetWare 5 client will support remote connections through an encrypted IP tunnel. Not only will this connection be secure, but you will have the same access to your network from a remote workstation as you do from a local workstation.

Terry L. Jeffress, author

The Year 2000 Bug

Linda Boyer's feature article in the June 1998 issue, "Exterminating the Millennium Bug Before It Wreaks Havoc on Your Company's Network," (*NetWare Connection*, June 1998, pp. 8-20) provided a great deal of useful information. However, the article missed one important area—checking Year 2000 software readiness. Linda Boyer's statement that "software leaves you little choice but to contact or check the web site of every vendor of every operating system and application on your company's network" is far from the truth. PinPoint's ClickNet Y2k does this for you.

ClickNet Y2k, an automated Year 2000 desktop compliance manager, provides a knowledge base of Year 2000 software readiness or compliance information on over 6000 commercial software titles. ClickNet Y2k automates the process of obtaining and updating this information, and mapping the compliance data against your network inventory, producing complete reports on the Year 2000 readiness of the PCs and desktop applications in your network.

John Kiger, director of Marketing at PinPoint Software Corporation

Clarification

In "NDS-Enabled Applications: What Do They Have That Other Applications Don't," (*NetWare Connection*, Aug. 1998, pp. 6-18), we stated on pp. 15-16 that you could download the OImport and OExport utilities from the Novell Consulting World-Wide Web site (<http://www.novell.com/consulting>). However, we failed to mention that you must purchase these utilities; they are not free. ●

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NetWare 5

Novell Returns to Its Roots

Linda Boyer

In a keynote address at COMDEX/Fall '97, Dr. Eric Schmidt, chief executive officer at Novell, emphasized Novell's renewed commitment to "deliver the kind of technologies that people need to run their networks." NetWare 5, which is scheduled for release this month, provides the best evidence both of Schmidt's claim and of his implication that Novell is returning to its roots.

Novell's roots lie in networking technologies and the networks that these technologies have helped create, starting fifteen years ago when Novell developed one of the first operating systems that allowed users to share files and printers. The return to the *NetWare* name emphasizes Novell's return to its roots. But the real proof of Novell's return to its roots lies in the features—not the name—of NetWare 5.

Ironically, the two NetWare 5 features that are the most different from previous versions of NetWare speak volumes about Novell's return to its roots: support for pure IP and support for Java. These features represent Novell's step toward a future of open, standards-based networking and Novell's renewed commitment to deliver the kind of technologies that people need to run their networks. Clearly, the technologies that people need today are Internet technologies.

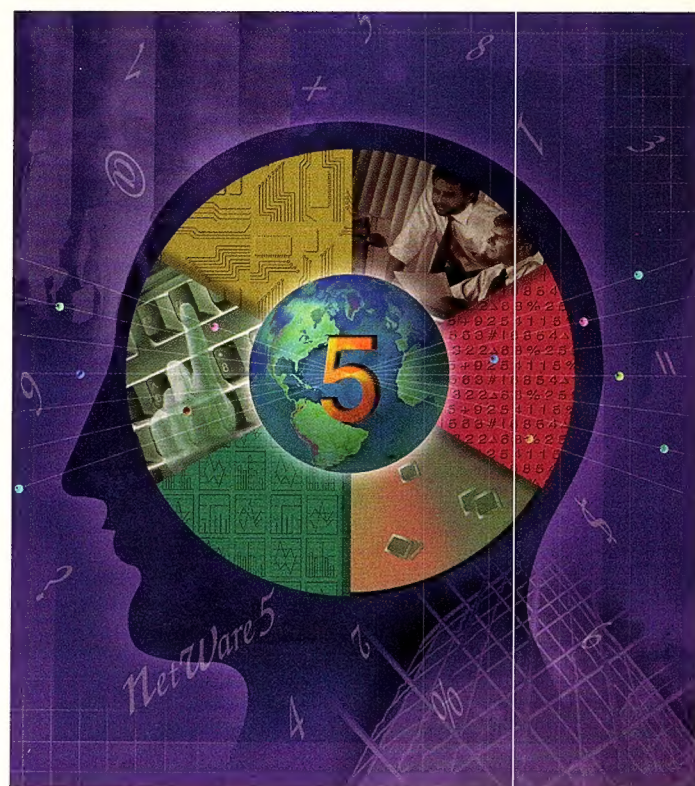
This article examines some of the features that are new to the NetWare operating system and a few features that are new to Novell Directory Services (NDS). (For more information about NetWare 5, see "NetWare 5 Knows No Limits," *NetWare Connection*, May 1998, pp. 6–21. You can download this article from <http://www.novell.com/nwc/may98/ntware58/index.html>.)

WHAT'S NEW IN THE OPERATING SYSTEM?

NetWare 5 includes several features that, in some cases, are radical departures from Novell's traditional NetWare platform:

Support for Pure IP

One significant difference between NetWare 5 and previous versions of NetWare is its support for pure IP, which is IP without encapsulation. Despite our Internet-centric world, NetWare 5 is the only operating system other than UNIX that offers pure IP as its core protocol. Other operating systems must encapsulate their own network-layer protocols within IP before transmitting data. For example, with previous versions of NetWare, you can run IP across the wire, but doing so requires NetWare/IP, which encapsulates IPX within IP. Similarly, you can run IP on Windows NT



networks, but Windows NT actually encapsulates NetBIOS within IP. Although encapsulating other protocols within IP does work, this solution can require more hardware and consume more bandwidth than running pure IP.

Not everyone is ready for pure IP, however. If your company wants to continue to run IPX, don't worry: NetWare 5 supports both IP and IPX, so you can use IP, IPX, or both. As a result, you can migrate your company's network to IP when you are ready. NetWare 5's compatibility mode option helps ease this migration process. Using the IPX compatibility mode option, you can integrate IP segments with IPX segments, and you can continue to run IPX-dependent applications—even on a NetWare 5 server. (For more information about the IPX compatibility mode option, see the related article on p. 34.)

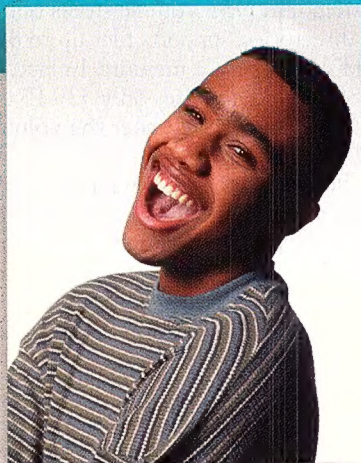
Support for Java

Another significant difference between NetWare 5 and previous versions of NetWare is its support for Java. At the heart of this Java support is Novell's Java virtual machine (JVM), a set of NetWare Loadable Modules (NLMs) that interprets Java scripts and executes these scripts on a NetWare 5 server. In NetWare 5, Novell implemented the JVM at the kernel level, enabling you to develop and run any Java-based application on a NetWare 5 server.

NetWare 5 ships with several Java-based applications, including the following:

- An installation utility with an X-Windows-based GUI. (For more information about the NetWare 5 installation process, see the related article on p. 12.)
- The DNS/DHCP Management Console, which is fully integrated with NDS and automatically updates host names. (See Figure 1 on p. 8. For more information about this utility, see "Check Out an IP Address with DNS/DHCP Services in

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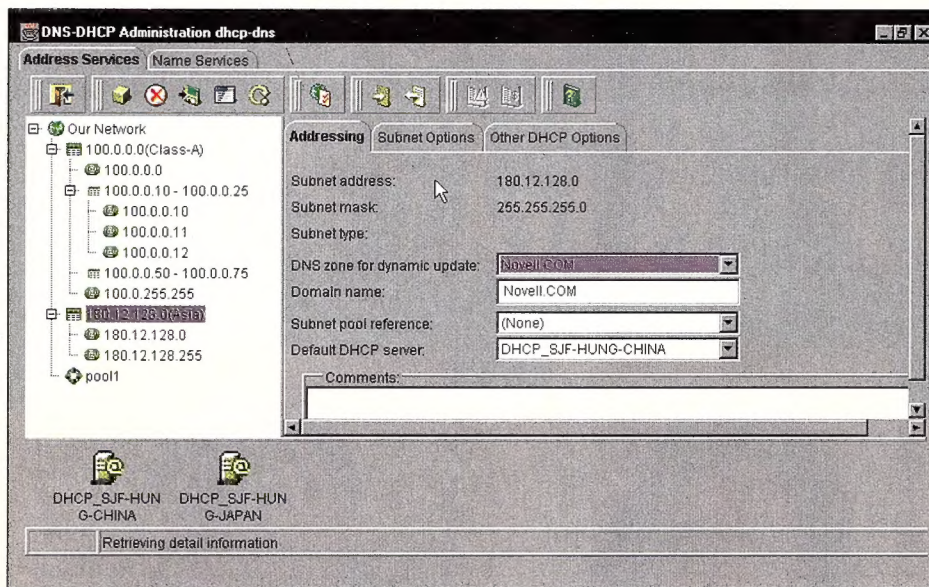


Figure 1. NetWare 5 includes a new Java-based, graphical utility for managing the DNS/DHCP services.

NetWare 5," *NetWare Connection*, Aug. 1998, pp. 36-42. You can download this article from <http://www.nwconnection.com/aug.98/dhcp>.)

- ConsoleOne, a GUI server console. (See Figure 2 on p. 10.)

The version of ConsoleOne that comes with NetWare 5 allows you to perform basic NDS management tasks. Future versions of ConsoleOne will provide the same level of functionality—and more—as Novell's NetWare Administrator (NWADMIN) utility. In addition, Novell plans to port all of its management utilities to Java so they will work with ConsoleOne. Eventually, ConsoleOne will provide a single console for managing every Novell product and any third-party product through a ConsoleOne snap-in module.

NetWare 5 also includes Java scripts, Java beans, and Java class libraries. These libraries expose NetWare application program interfaces (APIs), thus enabling developers to write Java-based applications that access NetWare 5 services, such as NDS. In addition, NetWare 5 includes a just-in-time compiler that interprets Java codes. The just-in-time compiler converts these Java codes into machine code in real time, dramatically increasing the speed at which a NetWare 5 server runs Java-based applications.

New Kernel

The NetWare 5 kernel is arguably as revolutionary as pure IP and Java support.

With this new kernel, NetWare 5 provides an optimal environment for running all applications, including Java-based applications. In fact, according to Greg Macris, product marketing manager at Novell, the kernel "makes NetWare 5 the best next-generation application server for distributed Internet and intranet applications." The kernel supports both uniprocessing and multiprocessing and includes features such as memory protection and virtual memory.

In most versions of NetWare, NLMs run at the kernel level. Although this implementation offers performance benefits, it is potentially risky: If an application running at the kernel level goes awry, this application may start overwriting memory outside of its own address space, causing the server to crash. NetWare 4 offers you the option of installing NLMs in protected mode. And with NetWare 5, Novell has perfected the protected mode option. Applications running in protected mode cannot write to any address space except their own. Therefore, when an application running in protected mode crashes, NetWare 5 continues to run.

As with memory protection, virtual memory also reduces the risk of the server crashing. When sufficient RAM is not available to complete an operation, NetWare 5 stores information temporarily on the hard drive, providing virtual memory. For example, if an application tried to use more RAM than were available on the server, NetWare 5 would use

the hard drive instead, and the application wouldn't know the difference.

New Storage System

In addition to creating a new kernel, Novell has created a new storage system for NetWare 5 called Novell Storage System (NSS). NSS is a 64-bit indexed storage system that shatters the existing file system's limitations while maintaining backward compatibility with that file system. An NSS volume stores billions of directories, supports files up to 8 TB, and requires little memory. In fact, an NSS volume requires only 32 MB of RAM to mount, whether the volume is 10 GB or 100 TB.

Furthermore, you can remount an NSS volume of any size in seconds. For example, in a demonstration at BrainShare '98 in Salt Lake City, Novell engineers intentionally crashed a 2.5-TB NSS volume, which they then remounted in only six seconds.

Other Features

NetWare 5 also includes the following new features:

- **Novell Distributed Print Services (NDPS).** NDPS improves bidirectional print communications and job scheduling. In addition, NDPS automatically installs printer drivers. (For more information about NDPS, see "NDPS: Good-bye, Queue World!" *NetWare Connection*, Oct. 1997, pp. 6-22. You can download this article from <http://www.novell.com/nwc/oct.97/ndps07>.)
- **Service Location Protocol (SLP).** SLP discovers network services for IP clients in pure IP and mixed IPX and IP environments, replacing Service Advertising Protocol (SAP), the traditional NetWare broadcasting protocol. (For more information about SLP, see "Service Location Protocol: Discovering Services in a Pure IP Environment," *NetWare Connection*, July 1998, pp. 32-37. You can download this article from <http://www.novell.com/nwc/jul.98/slp78>.)
- **DNS/DHCP Services.** The DNS/DHCP services automatically assign IP addresses and other configuration information to workstations when they are booted or when they make a request. Because the NetWare 5 DNS/DHCP services are based on industry standards, they interoperate seamlessly with other

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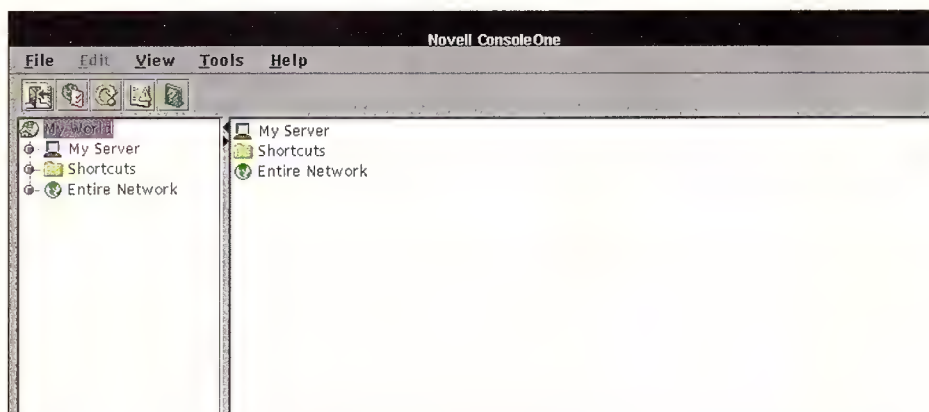


Figure 2. The version of ConsoleOne included with NetWare 5 is a GUI server console that allows you to perform basic NDS management tasks. Future versions of ConsoleOne will provide the same functionality and more as the NetWare Administrator (NWADMIN) utility.

DNS and DHCP services, regardless of the platform on which these servers run. However, NetWare 5 implements DNS/DHCP services through NDS, providing a single point of administration. (For more information about the DNS/DHCP services, see "Check Out an IP Address: With DNS/DHCP Services in NetWare 5," *NetWare Connection*, Aug. 1998.)

- **Oracle8 for NetWare.** Oracle8 is a scalable database management system that can hold several petabytes of data and deliver that data to many users. Oracle8 for NetWare allows you to use NDS to control users' access to the Oracle8 database. With a single login, users with the necessary rights are automatically authenticated to NDS and to the Oracle8 database. No separate usernames and passwords are needed to access Oracle8, and the login process is protected by the security features of NDS. (See Figure 3. For more information about Oracle8 for NetWare, see "Oracle8 for NetWare," *NetWare Connection*, May 1998, pp. 24–30. You can download this article from <http://www.nwconnection.com/may.98/oracle58>.)
- **Netscape FastTrack Server for NetWare.** Netscape FastTrack Server for NetWare is World-Wide Web server software that provides a cross-platform environment for creating and publishing web pages.
- **Zero Effort Networks (Z.E.N.works) Starter Pack.** NetWare 5 includes the Z.E.N.works Starter Pack, which offers all of the functionality currently available in Novell Application Launcher (NAL) 2.5 and Novell Workstation Manager 1.1. The Z.E.N.works Starter

Pack is a desktop management tool that uses NDS to simplify the process of managing Windows-based workstations. The Z.E.N.works Starter Pack also makes the network easier for users to use. If you like the Z.E.N.works Starter Pack, you can purchase the complete Z.E.N.works product. (For more information, see "Z.E.N.works Zeroes in on Workstations," *NetWare Connection*, April 1998, pp. 28–34. You can download this article from <http://nwconnection.com/apr.98/zen48>.)

WHAT'S NEW IN NDS?

In addition to its new operating system features, NetWare 5 includes many new NDS features.

Support for LDAP

NetWare 5 includes LDAP Services for NDS, which is based on LDAP version 3, an industry-standard protocol that allows users to access X.500-based directories via the Internet or an intranet. LDAP Services for NDS offers a server-based interface to NDS for LDAP-compliant applications running under Secure Sockets Layer (SSL).

Catalog Services

NetWare 5 also includes catalog services, which provide a flat-file, customizable catalog of the NDS database. With catalog services, both developers and network administrators can easily write applications that extract particular NDS information (for example, all usernames). To demonstrate the potential of catalog services, NetWare 5 includes an application that allows users to log in to the network from any workstation without

having to specify their NDS context. (This capability is called *contextless login*.)

NDS Synchronization

NetWare 5 improves the way NDS synchronizes replicas. With NetWare 4, if you changed replica A, this replica would attempt to send the change to replica B and to replica C. If replica A successfully updated replica B but not replica C, both replica A and replica B would try to update replica C until the update was successful.

NetWare 5 uses transitive synchronization: If you changed replica A, this replica would update replica B, which would then update replica C. Transitive synchronization provides two benefits:

- Transitive synchronization reduces network traffic created by replica updates. (Only one replica updates a particular replica, rather than all replicas trying to update to the same replica.)
- Transitive synchronization allows partition operations (such as partition splits or copies) to occur even if a server in a replica ring is not available.

WAN Traffic Manager

NetWare 5 includes WAN Traffic Manager, which is a snap-in module for the NWADMIN utility that allows you to create policies for controlling NDS replication traffic over WAN links. For example, you could create a policy to specify when the NDS servers at your company's branch offices should exchange replication information with the NDS server at your company's corporate office. You could specify that these servers should exchange replication information only between midnight and 3:00 a.m., when network utilization is low.

Security Features

NetWare 4.11 is the only client-server product that has earned Class C2 certification from the National Computer Security Center (NCSC). NetWare 5 builds on this reputation by offering several new NDS-enabled security features, including the following:

- **Public-Key Infrastructure (PKIS).** PKIS supports public-key cryptography and digital certificates in a NetWare 5 environment. (Digital certificates provide a method for checking the authenticity of keys used in a public-key crypt-

ographic session.) The PKIS infrastructure enables you to generate and sign various types of digital certificates, which you can then store and manage within NDS. These certificates are used in conjunction with LDAP lookups of NDS information. Specifically, SSL enables you to use a certificate pair to securely access NDS information by way of LDAP version 3. PKIS allows you to act as your own certificate authority or to use the services of a third-party certificate authority.

- **Secure Authentication Services (SAS).** SAS supports both existing and emerging authentication mechanisms, such as biometric- and token-authentication systems. Through SAS, NetWare 5 supports SSL version 3. Developers can use the SAS API included with NetWare 5 to write applications that can establish encrypted SSL connections.

CONCLUSION

By supporting open protocols and standards, such as IP, Java, DHCP, DNS,

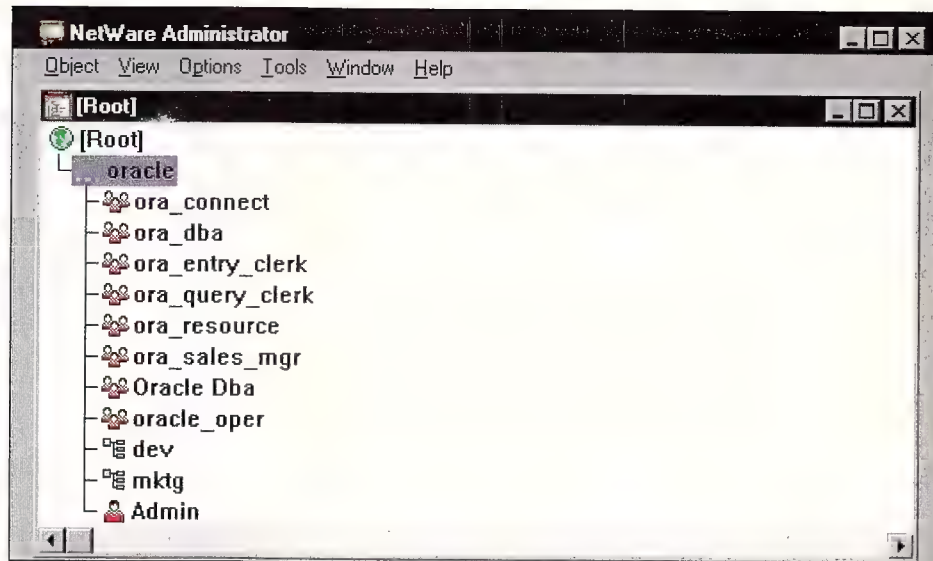


Figure 3. Because Oracle8 for NetWare is integrated with NDS, you can use the NWADMIN utility to manage your company's database.

and LDAP, NetWare 5 offers the best of both worlds: Not only is NetWare 5 a radical departure from previous versions of NetWare, but it also highlights Novell's renewed commitment to deliver the kind

of technologies that people need to run their networks.

Linda Boyer works for Niche Associates, an agency that specializes in technical writing and editing. ●

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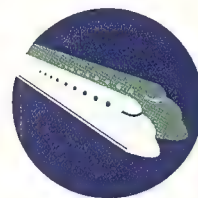
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Installing NetWare 5

With a Graphical Utility

Sandy Stevens

NetWare 5 offers many new features that make it the most advanced network operating system available. (For more information about these features, see the related article on p. 6.) One significant improvement is a new graphical installation utility, which greatly simplifies the installation process for both novice and experienced network administrators. In addition to being easy to use, the installation utility provides a common installation for all of the services and products included with NetWare 5. (For more information about these services and products, see "Services and Products Included With NetWare 5" on p. 18.) The installation utility also allows network administrators, systems integrators, and original equipment manufacturers (OEMs) to customize the installation to meet their needs.

IT'S SO EASY!

NetWare 5 provides a new bootable installation option, which can automatically boot the server to DOS, load the appropriate device drivers for the server's CD-ROM drive, and even create a DOS partition. You can then use the new graphical installation utility, which is 100-percent pure Java, to quickly and easily install NetWare 5. This installation utility has a standard GUI and a wizard that guides you through the installation process while hiding the complexities of this process.

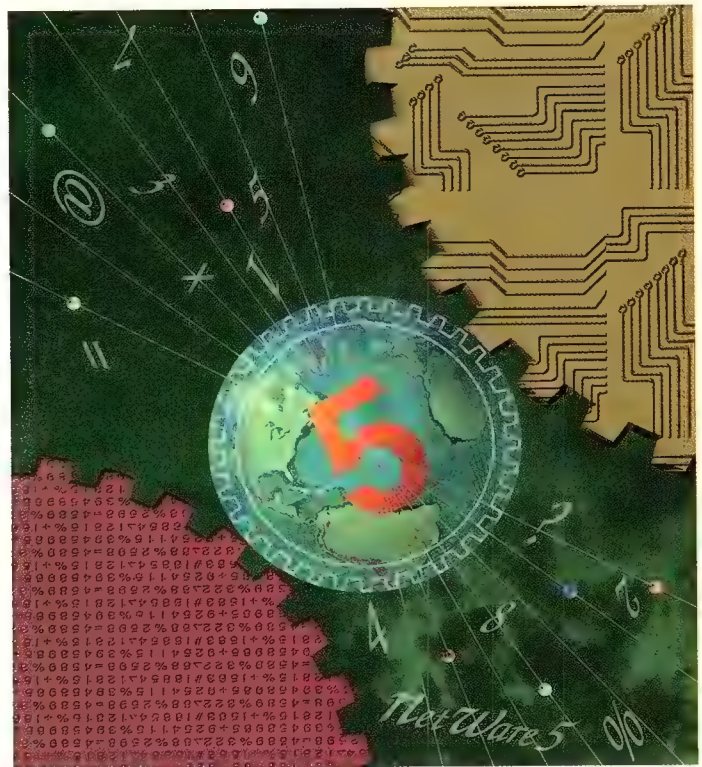
One-Stop Installation

Using the installation utility, you can install NetWare 5 and any service or product integrated with the NetWare 5 installation simultaneously. For example, you could install NetWare 5, LDAP Services for NDS, and Domain Naming Service (DNS)/Dynamic Host Configuration Protocol (DHCP) Services in a single step.

You can simply select the services and products you want to install with NetWare 5 and walk away. The installation utility then installs the files for the services and products you have selected. You do not have to install additional services and products individually after the installation process is completed.

Custom Installations

As mentioned earlier, the installation utility allows network administrators, systems integrators, and OEMs to customize the installation. For example, a systems integrator or a central IS department can create "cookie-cutter" installations by using response files that provide predefined values during the installation of NetWare 5. These response files simplify the installation process by automatically entering information that does not change from customer to customer (such as language and time zone).



NetWare 5 also supports phased installations. For example, a systems integrator or a central IS department could complete the first phase of the installation process by creating the DOS partition and the SYS volume and by performing the initial file copy. A customer could then use the graphical installation utility to complete the second phase of the installation process: The customer would define the server name, the network protocol bindings, the Novell Directory Services (NDS) installation, the licensing information, and other services and products to install.

INSTALLING NETWARE 5

The first step in the installation process is to set up the server hardware that will run NetWare 5. You must ensure that this server hardware meets the following minimum requirements:

- A PC with a 486, Pentium, or above processor. For optimal performance, Novell recommends a PC with a Pentium II or Pentium Pro processor that supports L2 cache.
- At least 64 MB of RAM. The absolute minimum amount of RAM you need is 64 MB. RAM requirements vary significantly, depending on the additional services and products you install. Novell is in the process of updating the existing Server Memory Calculation formula for NetWare 5 and will include this formula in the NetWare 5 online documentation when the product ships. This formula helps you estimate how much RAM you need for a particular file server configuration.
- At least one network interface board and network cabling. These components are obvious but necessary.
- A CD-ROM drive. You can install NetWare 5 from a server's local CD-ROM drive, from a CD-ROM drive that is mounted as a volume on a server, or from a network directory. If you install NetWare 5 from a network directory, the entire contents of the NetWare 5 CD-ROM are copied to this directory. From the server on which you want to install NetWare 5, you log in to the server that holds the network directory, map a drive to this

directory, and begin the installation.

- A hard drive with sufficient storage space for the network. You need enough hard drive space for the NetWare 5 operating system, additional services and products you want to install, network applications, and data files. (For more information, see "Services and Products Included With NetWare 5" on p. 18.) The hard drive space required for network applications and data files varies from server to server. To determine the hard drive space required for NetWare 5, you can use the following as a guide:
 - NetWare 5 only—250 MB
 - NetWare 5, plus default services and products—350 MB
 - NetWare 5, plus all services and products—450 MB
 - NetWare 5, plus all services and products and online documentation—600 MB

PERFORMING THE INSTALLATION

The installation of NetWare 5 has been simplified from the very start. If the server you are using supports booting from the CD-ROM drive, you can use the bootable installation option on the NetWare 5 installation CD-ROM. This CD-ROM automatically boots DOS, detects and loads the device drivers for the server's CD-ROM drive (most IDE and non-Compaq SCSI CD-ROM drives are supported), and launches the installation routine.

The installation routine begins with the familiar C-worthy interface used in previous versions of NetWare, but don't worry: Only part of the installation process uses the C-worthy interface; most of the installation process is performed through the graphical installation utility.

If you use the bootable installation option, you can have the DOS partition for NetWare 5 created automatically. If you want to create a DOS partition manually, you can use the NetWare 5 license diskette, which contains a DOS image as well as the FDISK and FORMAT utilities needed to create and format the DOS partition. You must create the DOS partition before you begin the installation process.

You can bypass the bootable installation option by using the traditional method of starting the installation routine: You manually boot the server to DOS, load the appropriate DOS-based device drivers for the server's CD-ROM drive, change to the CD-ROM drive, and type INSTALL at the DOS prompt.

After the installation routine is invoked (either through the bootable installation option or the INSTALL command), a graphical splash screen appears on the server console. This splash screen gives you something to look at while the installation routine initializes the server. If you want to see what is happening while the splash screen is displayed, use the NetWare toggle options (<Ctrl> <Esc> or <Alt> <Esc>) to switch to the server console.

If you switch to the server console, you will notice that the NetWare 5 installation routine automatically launches SERVER.EXE, which gives the server a temporary name of TEMPORARY and loads the NetWare Loadable Modules (NLMs) required for the installation. If you toggle back to the installation routine after these NLMs are loaded, the first screen that appears contains the Novell license agreement. You must accept this



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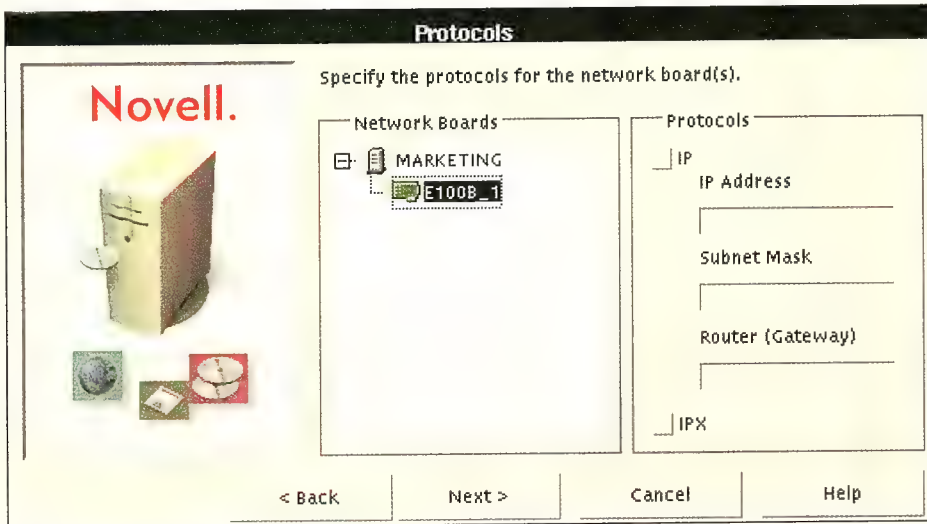


Figure 1. NetWare 5 supports both IP and IPX.

license agreement to continue with the installation.

The next screen allows you to select the type of installation—a new server or an upgrade—and to specify the server's startup directory. (The default startup directory is C:\NWSERVER.) You then click the Continue button to move to the next screen, which allows you to define the server's regional settings (country code page and keyboard type).

As mentioned earlier, because companies use the same values for certain settings, a systems integrator or a central IS department can create response files that provide predefined values. Then customers do not have to configure these settings during the installation routine.

Next, the installation routine tries to automatically detect the server's mouse

type and video mode. You must define these options to support the graphical installation utility.

The installation routine then copies all of the necessary files, drivers, and other NLMs to the server's startup directory. If you accepted the default setting, the startup directory is C:\NWSERVER.

Next, the installation routine tries to automatically detect hardware devices and select drivers for these devices:

- **Platform Support Module (PSM) Driver.** This driver is used to optimize servers with multiple processors. The PSM driver is optional. If the installation routine does not detect a PSM, the server hardware does not require this driver.
- **HotPlug Support Module Driver.** This driver is used with servers that support

HotPlug PCI, which allows you to add or remove HotPlug PCI boards while the server is running. The HotPlug support module driver is optional. If the installation routine does not detect a HotPlug support module, the server hardware does not require this driver.

- **Storage Adapter Drivers.** These drivers provide a link between the storage adapters and NetWare 5. The appropriate storage adapter drivers must be loaded before the installation routine can continue. If the installation routine cannot automatically detect the appropriate storage adapter drivers for the server hardware, you must manually select these drivers.

NetWare 5 does not support the .DSK drivers used with previous versions of NetWare. Instead, NetWare 5 uses the enhanced NetWare Peripheral Architecture (NWP), which requires a Host Adapter Module (HAM) and a Custom Device Module (CDM). HAM provides an interface to the storage adapter, and CDM provides an interface to the storage device. At this point, if the HAM is not automatically detected, you must select the appropriate HAM for the server's storage adapter. If the server has multiple storage devices controlled by one adapter, you may need to select only one HAM.

After the installation routine selects these device drivers, the next screen appears. The installation routine then tries to automatically detect other hardware devices and to select the appropriate drivers for these devices:

- **Storage Device Drivers.** These drivers are the CDMs that allow storage devices—such as hard drives and CD-ROM drives—to communicate with the server's storage adapter. The installation routine tries to match the CDM to the HAM selected earlier. If the installation routine didn't automatically detect the HAM, you must manually select the appropriate CDM for each type of storage device in the server.
- **Network Boards.** These drivers are for the server's network boards. The installation routine automatically detects the drivers for most network boards. If the installation routine cannot select the appropriate drivers, you must manually select these drivers.

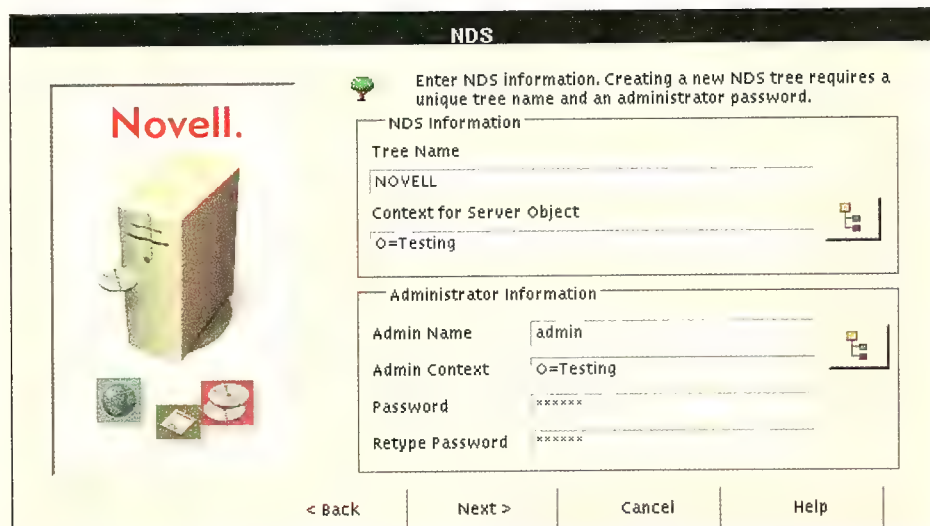


Figure 2. The graphical installation utility simplifies the process of installing NDS.



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Services and Products Included With NetWare 5

Service or Product	Description	Default Selection
LDAP Services for NDS	Allows clients to access NDS information through LDAP 3.0.	Yes
NDS Catalog Services	Allows NDS information to be stored in a catalog database, which speeds up searches for a specific NDS object (such as a User object).	Yes
WAN Traffic Manager Services	Allows you to control WAN traffic by using policies that define how network services, such as NDS, use WAN links.	Yes
Secure Authentication Services	Provides Secure Socket Layer (SSL) 3.0 support, which allows you to secure connections between servers and clients through the use of certificate pairs.	Yes
Novell's Public Key Infrastructure Services	Provides an infrastructure that allows you to use public-key cryptography and digital signatures. Provides key generation & certificate management capabilities.	Yes
Remote Access Services (RAS)	Provides remote access services.	Yes
Storage Management Services	Allows you to create and manage Storage Services objects, which are used for network backup.	Yes
Novell's DNS/DHCP Services	Provides enterprise-wide management of DNS and DHCP information by storing that information in the NDS tree.	No
Documentation CD-ROM	Installs online documentation.	No 

The final option on this screen allows you to select and load NLMs before the installation routine continues. Although you probably do not need this option, you can use it if your particular configuration requires NLMs to be loaded before the installation routine continues.

After all of the device drivers are selected, the NetWare 5 installation routine loads each driver.

Creating NetWare 5 Disk Partitions

Before moving to the next step in the installation routine, which is the creation of the NetWare partition, you should understand how Novell has changed the NetWare 5 file system. NetWare 5 offers two file systems: the traditional NetWare file system and Novell Storage Services (NSS), which is a new, high-performance file system that significantly improves the capacity and scalability of the traditional NetWare file system.

You must create a separate partition for each file system: You must create a traditional NetWare partition for volumes that use the traditional NetWare file system. For example, the SYS volume uses the traditional NetWare file system. You must create a separate partition for volumes that use NSS.

The next installation screens allow you to define the traditional NetWare partition and the SYS volume. NetWare 5 partitioning can get a bit tricky because the installation routine, by default, allocates all available hard drive space to the traditional NetWare partition. If you want to use NSS, you must modify the size of the

traditional NetWare partition, leaving enough hard drive space for the NSS partition. (You use the graphical installation utility to define the NSS partition and volumes and to define other volumes that will use the traditional NetWare file system.)

After creating the traditional NetWare partition and the SYS volume, the installation routine mounts the SYS volume, copies various installation modules to the SYS volume, and installs the Java Virtual Machine (JVM) and related components.

Using the Graphical Installation Utility

After the JVM is loaded, the NetWare 5 graphical installation utility is loaded in the JVM space. The first graphical screen that appears allows you to name the server. Because the installation utility uses a standard GUI, you can use the mouse as you enter information.

The next screen allows you to continue configuring the file system. If you left hard drive space unpartitioned when the traditional NetWare partition was created, you can select that hard drive space, and click the Create button. You can name the volume you want to create and select the type of volume: traditional or NSS.

You then specify the amount of available hard drive space to use for the volume and click the Apply to Volume button to allocate this hard drive space. After you define this volume, you can define additional volumes (if unpartitioned space remains). After you define all of the volumes, you click the Next button and specify whether you want the volumes mounted now or when the server is rebooted.

Choosing Network Protocols

The next screen allows you to configure the network protocols used by this server. (See Figure 1 on p. 16.) You click the network interface boards displayed and select the protocol you want to use—IP or IPX. NetWare 5 provides several options:

- **IP Only.** This option enables a pure IP network with no IPX on the wire.
- **IP with IPX Compatibility Mode.** This option enables IP but provides backward compatibility with IPX-only clients, servers, or applications. In this case, IPX is used only when necessary.
- **IPX Only.** This option enables a traditional IPX-only network.
- **IP and IPX.** This option enables both protocols.

By clicking the IP check box in Figure 1, you enable IP with IPX compatibility mode. (For more information about IPX compatibility mode, see the related article on p. 32.) After the installation, you can disable the IPX compatibility mode by removing the LOAD SCMD command from the server's AUTOEXEC.NCF file. If you select the IP check box, you must define the server's IP address and subnet mask. You can also specify a router's IP address to define a static route.

By clicking the IPX check box, you enable only IPX. If you select both IP and IPX, you enable both protocols.

Configuring the Time Zone and NDS

The next screen that appears allows you to select the appropriate time zone for

the server. NDS uses the time zone information defined here to properly update NDS replicas across time zones.

After you select the time zone, the installation utility guides you through the process of installing NDS. First, you specify whether you are installing the NetWare 5 server in a new NDS tree or an existing NDS tree. You then define the name of the NDS tree and the NDS context for the Server object. (See Figure 2 on p. 16.) When you define the NDS context for the Server object, you can click the tree icon to browse an existing NDS tree or to create a new NDS tree.

Next, you define the ADMIN name, NDS context, and password. Once again, you can browse the NDS tree to select the NDS context for the ADMIN user.

After NDS is installed and configured, the installation utility prompts you to install the NetWare license file from the NetWare 5 license diskette.

Installing Services and Products

As mentioned earlier, the installation utility allows you to install other services and products at the same time you install NetWare 5. The next screen that appears allows you to select the services and products you want to install. Many of these services and products are installed by default. (See "Services and Products Included With NetWare 5.")

By simply adding or removing check marks, you can customize the installation. The installation utility copies the files for the services and products you select at the same time this utility copies the files for NetWare 5. If you do not install a particular service or product at this point, you can use the NWCONFIG NLM (which replaces the INSTALL NLM used with previous versions of NetWare) to install this service or product later.

After you select the services and products you want to install, you may be prompted to enter specific configuration information for a particular service or product. For example, both LDAP Services for NDS and DNS/DHCP Services require specific configuration information.

After you provide the necessary configuration information, a summary screen appears, allowing you to view and modify the parameters you set for the installation process. If these parameters are correct, you can begin the installation process by clicking the Finish button. You can then walk away from the installation process

and return 15 to 20 minutes later to a fully installed NetWare 5 server.

CONCLUSION

Installing NetWare 5 is much easier than installing previous versions of NetWare. For example, the bootable installation option allows you to quickly start the installation routine, and the hardware autodetection feature helps you quickly load device drivers. In addition, the new

graphical installation utility guides you through the installation process. The installation utility even allows you to install additional services and products at the same time you install NetWare 5, saving you time and effort. In short, NetWare 5 provides an installation for the masses.

Sandy Stevens is a freelance writer based in Salt Lake City, Utah. She is the coauthor of Novell's Guide to NetWare Printing and Novell's Guide to BorderManager. ●

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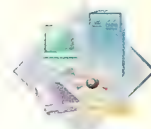
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Products That Support NetWare 5

If you are planning to upgrade to NetWare 5, you need to know how third-party companies are supporting this new version of NetWare. After all, you need the absolute essentials—such as server hardware, backup software, print server software, antivirus software, and management software—as well as all of the applications users require to do their jobs.

You will be pleased to know that Novell is working with hundreds of third-party companies to ensure that their products support NetWare 5. The products featured in this article are just a small sample of the products that will support NetWare 5 when—or shortly after—it ships this month. (Novell has announced that NetWare 5 will ship on or before September 20.) However, these products will give you an idea of the kinds of products that are available for NetWare 5.

To ensure that third-party products support Novell products, such as NetWare 5, Novell offers a program called Yes, Tested and Approved. Through this program, third-party companies submit their product to Novell for a battery of tests. If the product passes these tests, Novell issues a Yes, Tested and Approved bulletin, which is posted on Novell's World-Wide Web site. This bulletin details the scope of the tests, including which products (such as Novell products, network interface boards, and controller devices) were used in these tests. For more information about Novell's Yes, Tested and Approved program, visit Novell's web site (<http://developer.novell.com>). ●

CONFIGCENTRAL 2.2

ConfigCentral 2.2 from NetPro Computing Inc. is a server-based utility that allows you to manage NetWare Loadable Modules (NLMs) across multiple servers. With ConfigCentral 2.2, you do not have to manually distribute NLMs on a server-by-server basis. You can perform the following tasks from a central location:

- Load and unload NLMs
- Execute console commands
- Edit .NCF files
- Reboot servers

ConfigCentral 2.2 also helps you troubleshoot NLM problems by locating out-of-date NLMs. You can determine which NLMs are loaded and unloaded on each server by viewing or printing reports that compare NLMs between servers. These reports display version numbers, file sizes, file dates, and other information.

You can then schedule NLMs to be distributed to servers that are not running a particular NLM or that are running an outdated version of the NLM. You can even use the Undo feature to reverse this distribution process later.

For more information about ConfigCentral 2.2, visit NetPro Computing's World-Wide Web site (<http://www.netpro.com>). You can also call 1-800-998-5090 or 1-602-941-3600.

OMNIGUARD/ENTERPRISE SECURITY MANAGER

OmniGuard/Enterprise Security Manager (ESM) from AXENT Technologies Inc. is a security management application that simplifies the process of implementing security policies in a heterogeneous network environment. Instead of creating separate security policies that cover the same issues on different platforms, you can use OmniGuard/ESM to evaluate all of the platforms on your company's network based on a standard security policy.

OmniGuard/ESM supports more than 35 server and workstation platforms, including NetWare, Windows NT, and UNIX. In addition, OmniGuard/ESM provides a GUI that allows you to configure and manage security policies from any Windows NT, Windows 98, Windows 95, Windows 3.x, or UNIX workstation. By using this GUI, you can implement default settings to create a security policy,

or you can customize a security policy to meet the needs of your company.

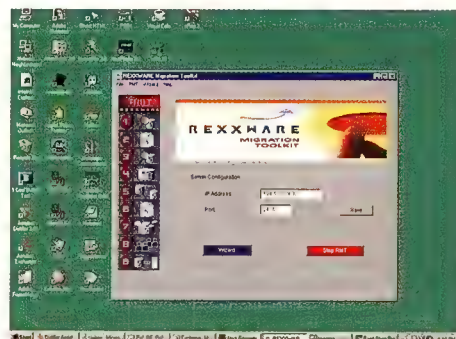
With OmniGuard/ESM, you can also view reports that help you determine what security policies are currently in place. And if you want to implement a new security policy or modify an existing security policy, you can distribute these changes across all of the platforms on your company's network from a central location.

For more information about OmniGuard/ESM, visit AXENT Technologies' web site (<http://www.axent.com>). You can also call 1-800-298-2620 (ext. 801) or 1-301-258-5043.

REXXWARE MIGRATION TOOLKIT 2.0

REXXWARE Migration Toolkit 2.0 from Simware Inc. is a server-based utility that allows you to migrate users and files from a NetWare 3 server to a NetWare 4 or NetWare 5 server. With REXXWARE Migration Toolkit 2.0, you can transfer files between servers, maintain users' passwords, and import bindery information to the Novell Directory Services (NDS) tree. You can also plan your company's NDS tree before you perform the migration process.

Unlike previous versions of the toolkit, REXXWARE Migration Toolkit 2.0 includes a GUI written in Java. As a result, you can access REXXWARE Migration



Simware's REXXWARE Migration Toolkit 2.0

Toolkit 2.0 both from the server or from any workstation on the network. REXXWARE Migration Toolkit 2.0 also includes an easy-to-use migration wizard, which guides you through the migration process.

REXXWARE Migration Toolkit 2.0 is scheduled for release shortly after NetWare



5 ships. You will then be able to download this product free from <http://www.simware.com/products/rmt>.

For more information about REXX-WARE Migration Toolkit 2.0, visit Simware's web site (<http://www.simware.com>). You can also call 1-800-267-9991 or 1-613-727-1779.

SFLOGIN 32 2.11

SFLOGIN 32 2.11 from Netoria Inc. is an NDS-enabled utility that makes logging in to the network easier for users and offers new management capabilities for network administrators. Because SFLOGIN 32 2.11 provides a contextless login for NDS, users do not need to know their NDS context to log in to the network. Instead, users can log in to the network from any workstation by entering only their username and password. Other features include a graphical NDS browser, a frequent login list, and customizable login screens.

As mentioned earlier, SFLOGIN 32 2.11 also offers new management capabilities. For example, you can define additional password parameters for increased security, and you can synchronize NDS, Windows, and Lotus Notes passwords automatically.

SFLOGIN 32 2.11 supports Windows NT, Windows 98, Windows 95, Windows 3.x, and DOS, and SFLOGIN 32 2.11 runs on intraNetWare or above. You must install Novell's latest client software on each workstation before you install SFLOGIN 32 2.11. In addition, the administration workstation must have Internet access.

You can download a free, 60-day trial version of SFLOGIN 32 2.11 from <http://www.netoria.com>. For more information about SFLOGIN 32 2.11, visit Netoria's web site (<http://www.netoria.com>). You can also call 1-888-227-0744 or 1-801-227-0722.

ORACLE8 FOR NETWORK

Oracle8 for NetWare from Oracle Corp. combines the industry-leading database with the industry-leading network operating system. Oracle8 is a scalable database management system that is optimized for the NetWare platform and

provides users with secure access to database information.

Oracle8 for NetWare offers several enhancements over Oracle7. For example, users can create tables with up to 1,000 columns in Oracle8 for NetWare, compared to 254 columns in Oracle7. In addition, Oracle8 for NetWare supports more concurrent users than Oracle7: 50,000 concurrent users were supported in benchmark tests.

Oracle8 for NetWare also offers new security capabilities, such as enhanced password management capabilities. And because Oracle8 for NetWare is integrated with NDS, you can manage the database from a central location by using Novell's NetWare Administrator (NWADMIN) utility.

To read all about Oracle8 for NetWare, see "Oracle8 for NetWare," *NetWare Connection*, May 1998,

pp. 24-30. (You can download this article from <http://www.nwconnection.com/nwc/may98/oracle58>.) You can also visit Oracle's web site (<http://www.oracle.com/products/uds/oracle8.html>). If you live in the United States or Canada, you can call 1-800-672-2531. If you live outside the United States or Canada, you can locate an Oracle sales

office near you at <http://www.oracle.com/corporate/salesoffices/html/index.html>.

HEWLETT-PACKARD PRINTER GATEWAY

The Hewlett-Packard (HP) Printer Gateway from Hewlett-Packard Co. provides an interface between Novell Distributed Print Services (NDPS) and NDPS-compliant network printers that are connected to HP JetDirect print servers. Jointly developed by Novell, HP, and Xerox, NDPS makes network printers easier for you to manage and for users to use. For example, NDPS eliminates the need to create Print Queue objects, Printer objects, and Print Server objects.

The HP Printer Gateway acts as an interpreter between NDPS and the HP

JetDirect print servers. Using the Simple Network Management Protocol (SNMP), the HP Printer Gateway gathers information from the printer and converts this information into a format that NDPS understands. In addition, the HP Printer gateway performs the following tasks:

- Autodetects printers
- Automatically installs printers
- Provides status updates
- Automatically downloads print drivers

To use the HP NDPS Gateway, you must have NDPS installed on the server, which must also be running intraNetWare or above.

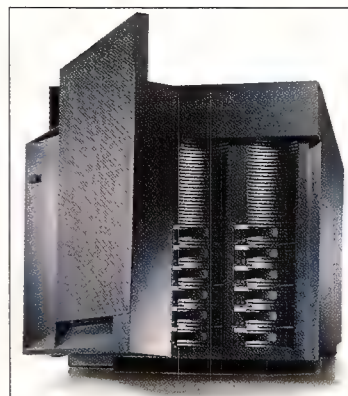
The HP Printer Gateway comes with NDPS. For more information about the HP Printer Gateway, visit HP's web site (<http://www.hp.com/go/networkprinting>). You can also call 1-650-857-1501. For more information about NDPS, visit Novell's web site (<http://www.novell.com/intranetware/products/ndps>). You can also call 1-800-NETWARE or 1-801-861-5588.

XEROX NDPS GATEWAY

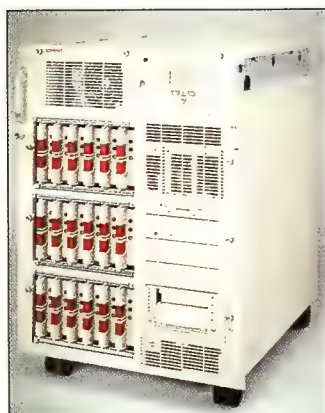
The Xerox NDPS Gateway from Xerox Corp. provides an interface between NDPS and NDPS-compliant Xerox printers. The Xerox NDPS Gateway includes an easy-to-use installation wizard that allows you to quickly install Xerox printers on the network. In addition, the Xerox NDPS Gateway automatically downloads printer drivers and provides information about print job status.

Because the Xerox NDPS Gateway is integrated with the NWADMIN utility, you have complete control over printing, and you can manage your company's Xerox printers from a central location.

To use the Xerox NDPS Gateway, you must have NDPS installed on the server, which must also be running intraNetWare or above. Each workstation must be running intraNetWare Client 2.2 or above. The server requires a minimum of 24 MB of RAM, and each workstation requires a minimum of 16 MB of RAM.



IBM's Netfinity 7000



Compaq's Proliant 7000



Server Hardware

Novell is working with several hardware vendors to ensure that server hardware supports NetWare 5 when it ships. We spoke to three leading hardware vendors to find out how they are supporting NetWare 5:

COMPAQ COMPUTER CORP.

All of Compaq's current servers support NetWare 5, and Compaq is working with Novell to have these servers Novell Yes, Tested and Approved for NetWare 5. In addition, Compaq is incorporating NetWare 5 with the next version of SmartStart, which ships on all Compaq servers. SmartStart is designed to simplify the process of installing operating systems on Compaq servers. For example, the next version of SmartStart will be able to optimize the hardware and software configuration for NetWare 5. SmartStart will also install the correct NetWare 5 drivers for the server hardware. Compaq plans to add support for NetWare 5 shortly after NetWare 5 ships.

Compaq's high-end servers also include a PCI HotPlug feature. With NetWare 4 running on these servers, you can replace a PCI card without downing the server. With NetWare 5 running on these servers, however, you can also swap or upgrade a PCI card without downing the server.

To help you upgrade to NetWare 5, Compaq will host a World-Wide Web site called the *Online Competency Center*, which will feature white papers, upgrade tips, benchmark tests, and a migration tool. The migration tool will address hardware issues, such as device drivers, in the upgrade process.

As we go to press, Compaq is creating this web site. When the web site is live, you can find a link to it on the *NetWare Connection* web site (<http://www.nwconnection.com>). As we get closer to September 20, the ship date for NetWare 5, check the *NetWare Connection* web site for this link.

For more information about Compaq servers, visit Compaq's web site (<http://www.compaq.com>). You can also call 1-800-OK-COMPAQ or 1-281-370-0670.

DELL COMPUTER CORP.

All of Dell's current servers support NetWare 5, and Dell is working with Novell to have these servers Novell Yes, Tested and

Approved for NetWare 5. Shortly after NetWare 5 ships, Dell will also offer factory installation of NetWare 5 on Dell servers. You will then be able to request a red-box, or standard, installation, or you can have Dell customize NetWare 5 for your company's network. In addition, Dell can install other software—including custom software, such as an in-house application—on the server for you.

Because the technical personnel installing NetWare 5 are CNEs, they can create your company's Novell Directory Services (NDS) tree, or they can fit the new NetWare 5 server into your company's existing NDS tree. These technical personnel can even configure IP addresses for your company's network.

Having Dell install NetWare 5 offers several benefits. For example, Dell provides technical support for both the hardware and the software, providing a single point of contact. You also receive 30 days of free technical support. And if Dell's technical support personnel cannot resolve a particular problem, they can escalate the problem to Novell because Dell has a preferred service agreement with Novell.

You can order Dell servers via the Internet. You can actually build the server to meet your company's specifications, and then you can check the status of your order—all through Dell's web site (<http://www.dell.com>).

For more information about the partnership between Dell and Novell, visit Dell's web site (<http://www.dell.com/nos>). If you live in the United States or Canada, you can also call 1-800-888-6152. If you live outside the United States or Canada, you can find contact information at <http://www.dell.com/global/index.htm>.

IBM CORP.

Like Compaq and Dell, IBM is working with Novell to have its servers Novell Yes, Tested and Approved for NetWare 5. Specifically, IBM is having the following servers tested: Netfinity 7000, 5500, 3500, and 3000, as well as IBM PC Server 704, 325, 330, 520, 320, 315, and 310.

Some of IBM's servers also include a PCI HotPlug feature. As mentioned earlier, NetWare 5 supports this feature, allowing you to replace, swap, or upgrade a PCI card without downing the server.

For more information about IBM's servers, visit IBM's web site (<http://www.ibm.com>). You can also call 1-800-IBM-7255 (ext. 4761) in the U.S. and Canada or 1-770-863-1234 in other areas. ●

The Xerox NDPS Gateway is available free with all Xerox printers, or you can download the Xerox NDPS Gateway from <http://xerox.networkprinters.com/products/ndps>. You can also call 1-800-34-XEROX, or you can contact your local reseller.

VOLANOCHAT 2.0 AND VOLANOCHATPRO 2.0

VolanoChat 2.0 and VolanoChatPro 2.0 from Volano LLC are Java-based applications that you can use to implement chat rooms on a NetWare server. You can create several types of chat rooms, including sales counters, customer help desks, multimedia conference rooms, distance learning centers, and online communities.

To meet the needs of each type of chat room, you can customize these chat rooms. For example, you can add graphics and display banner ads.

Both VolanoChat 2.0 and VolanoChatPro 2.0 allow you to create multiple chat rooms and to build a chat network by connecting chat rooms on hundreds of web sites to a central chat server. VolanoChat 2.0 and VolanoChatPro 2.0 also allow you to monitor the status of these chat rooms in real time, to manage chat clients, and to view a chat log. In addition, VolanoChatPro 2.0 offers advanced features, such as support for personal chat rooms and database connectivity.

VolanoChat 2.0 and VolanoChatPro

2.0 consist of a Java server application and Java applets that run on each chat client. The Java server application supports any computer running a Java Virtual Machine (JVM). The Java applets support any computer running a Java-enabled web browser, such as Netscape Navigator or Microsoft Internet Explorer.

You can download a free trial version of VolanoChatPro 2.0 from <http://www.volano.com/trial.html>. This trial version allows a maximum of five concurrent chat connections.

For more information about VolanoChat 2.0 or VolanoChatPro 2.0, visit Volano's web site (<http://www.volano.com>). You can also call 1-415-587-4297. ●

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Making the Mainframe Connection

With intraNetWare for SAA 3

James E. Gaskin

Why did Novell release intraNetWare for SAA 3? Isn't the mainframe dead?

Although people have been predicting the death of the mainframe for years, the mainframe is not only surviving but thriving: Faced with extinction, the mainframe has mutated, becoming a data-mining mother lode, an electronic commerce hub, and sometimes even a World-Wide Web server. (Instead of dying, this old dog has learned some new tricks, as our illustration shows!)

In fact, more than three-quarters of all corporate data still reside on mainframes. According to IBM, 470 of the Fortune 500 companies use Customer Information Control System (CICS), the transaction-processing monitor software for mainframes that allows programmers to develop display screens without writing special functions for each type of terminal. Industry analysts do not dispute IBM's numbers or its control of the mainframe market.

Because the mainframe continues to thrive, more users today than ever before need to connect to the mainframe, enabling new users to access corporate data. Many companies are using Systems Network Architecture (SNA) gateways such as intraNetWare for SAA 3 to make this connection.

Companies are also using SNA gateways to connect users to an AS/400 server. International Data Corp. (IDC) Research estimates that 50 percent of SNA gateways sold are to companies that have AS/400 servers.

Furthermore, SNA gateway sales worldwide are increasing. For example, industry analysts estimate that 74,500 SNA gateways will be sold in the United States in 2000 and 82,800 SNA gateways will be sold in 2001. There are several reasons for this increase in SNA gateway sales:

- Companies need an SNA gateway that supports web-to-host connectivity and TCP/IP. Because companies are using mainframe data to provide content on the Internet, web-to-host gateways are making a tremendous impact on the SNA gateway market. IDC says flatly that this product line "is the most significant product introduction in host access since PC emulators began to replace the fixed-function terminal. This product will expand the use of mainframe data within corporate intranets and to the consumer through the Internet."

- Companies are replacing older SNA gateways that have limited functionality. Early SNA gateways are relatively simple devices: a semi-intelligent gateway platform replaced an IBM 3174 cluster controller or physical unit (PU). These SNA gateways provide a maximum of 32 sessions, the number allowed by the cluster controller. Many of these older SNA gateways are DOS-based and outdated. In addition, these gateways are not year-2000 ready and do not support TCP/IP.

SNA gateways should offer a number of capabilities: For example, SNA gateways should take advantage of today's servers, which support thousands of concurrent connections. SNA gateways should provide advanced management capabilities (something early gateways can't provide). SNA gateways should also be year-2000 ready and support TCP/IP. And finally, SNA gateways should be flexible because increased programming requirements for all levels of IBM's Systems Application Architecture (SAA) demand this flexibility.

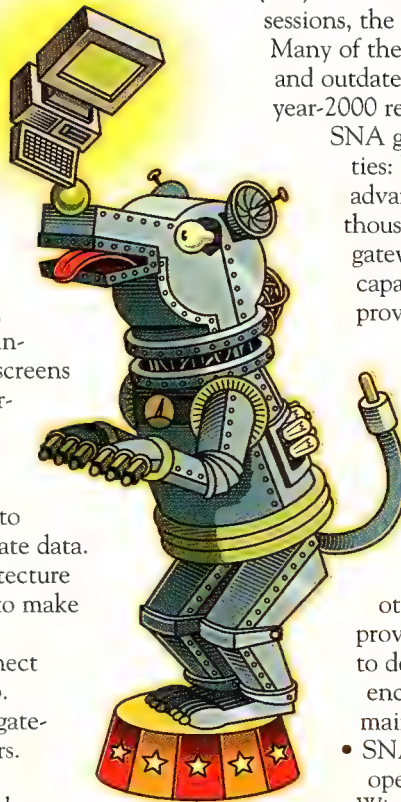
- More users need access to mainframe data. If users don't have mainframe access, they must rely on

others—usually service organizations—to provide the mainframe data these users need to do their job. Companies can increase efficiency by giving these users direct access to mainframe data.

- SNA gateways should support today's desktop operating systems, including Windows 95, Windows 98, and Windows NT. Although

many reports place Windows 3.1 on half of corporate desktops today, the trend to upgrade these desktops is accelerating. These upgrades are fueled by lower-priced hardware and the lack of new software for Windows 3.1. In the mainframe world, companies are also upgrading workstations to take advantage of 32-bit emulators that support Novell Directory Services (NDS).

Novell's intraNetWare for SAA 3 offers a solution for all of these problems—and it's year-2000 ready. intraNetWare for SAA 3 runs on intraNetWare or NetWare 4.11 and connects network clients of all types to IBM mainframe and AS/400 hosts. In addition, intraNetWare for SAA 3 offers the following features:



- Manageability through integration with (NDS) and enterprise management systems
- Fault tolerance and load balancing between SNA gateways
- Web-to-host connectivity
- Support for additional clients
- Support for a variety of network protocols
- Optional e-mail gateways

CRITICAL MANAGEMENT CAPABILITIES

Are you surprised that half of all corporate PCs still run Windows 3.1? Although companies have several reasons for not upgrading their workstations, the most important reason may be the near impossibility of physically reaching, updating, and reconfiguring thousands of workstations. (Novell's Zero Effort Networks [Z.E.N.works] provides a way to update and reconfigure workstations—a topic for another article.)

If you cannot configure and manage a product—including an SNA gateway—from a remote location, your company probably cannot afford to install that product. The deal-killer is not the product's initial cost but the cost of managing the product and supporting users who access the product.

intraNetWare for SAA 3 is the only directory-enabled SNA gateway available today: Through NDS, intraNetWare for SAA 3 provides improved security, centralized management, and simplified management of gateway resources such as logical unit (LU) pool and host connections. As a result, upgrading to intraNetWare for SAA 3 is more cost-effective than maintaining your company's current SNA gateway, which is not directory enabled.

A combination of NDS and snap-in modules for Novell's NetWare Administrator (NWADMIN) utility allows you to manage intraNetWare for SAA 3 and control access to its resources:

- **Access Control.** You can control users' access to the intraNetWare for SAA 3 gateway through NDS just as you control users' access to other network resources.
- **Centralized Management.** You can use the familiar NWADMIN utility to manage the intraNetWare for SAA gateway. Because the SAA Configurator utility and the intraNetWare for SAA Service Manager "snap" into the

NWADMIN utility, you can access these utilities through the Tools menu of the NWADMIN utility. The SAA Configurator utility allows you to configure the intraNetWare for SAA 3 gateway, and the SAA Service Manager allows you to manage the gateway. (You can also run both utilities standalone.)

- **Resource Management.** Using the NWADMIN utility, you can control gateway resources such as LU pools and dedicated LUs. You simply point and click to assign these resources to users or groups.

You will especially appreciate the SAA Services Manager, which includes extensive management tools for monitoring and maintaining intraNetWare for SAA 3 gateways anywhere on the network. With SAA Services Manager, you can dynamically control services all the way down to the session level. For example, you can perform the following management tasks:

- Load and unload NLMs.
- Restart a remote NetWare for SAA 3 gateway.
- Reload communication services.
- Begin a trace on a session.
- Reset a host session.
- Get real-time information such as session status, network address, user ID, and LU pool status.
- Collect trend data over configurable time settings for LU usage per PU profile, LU pool usage, concurrent licensed-user activity, link throughput, and even adapter errors. You can display statistics collected at defined intervals as graphs or print the statistics for later analysis.

Alerts from intraNetWare for SAA 3 gateways appear in the Event Monitor window of SAA Services Manager. These alerts include monitoring fault tolerance and performance of intraNetWare for SAA 3 gateways.

In addition, intraNetWare for SAA 3 offers the following advanced management features:

- **Integration with Enterprise Management Systems.** intraNetWare for SAA 3 was the first SNA gateway to provide NetView host-based management of NetWare. (NetView is IBM's host-

based management platform.) intraNetWare for SAA 3 is a NetView entry point, which means one intraNetWare for SAA 3 gateway can provide information to NetView for multiple NetWare servers running the NetWare Management Agent (NMA).

The NetView support is so well done that you can load and unload NetWare Loadable Modules (NLMs), manage volumes, and even manage NDS from host control stations. intraNetWare for SAA 3 also supports Tivoli's Tivoli Management Framework, Hewlett-Packard's OpenView, and Computer Associates' Unicenter.

- **Support for Simple Network Management Protocol (SNMP).** You can manage intraNetWare for SAA 3 with any SNMP-compliant management console, such as Novell's ManageWise. This feature makes intraNetWare for SAA 3 fit easily into an existing corporate management hierarchy.
- **Support for NetView Response Time Monitor (RTM).** You can use NetView to monitor the response time

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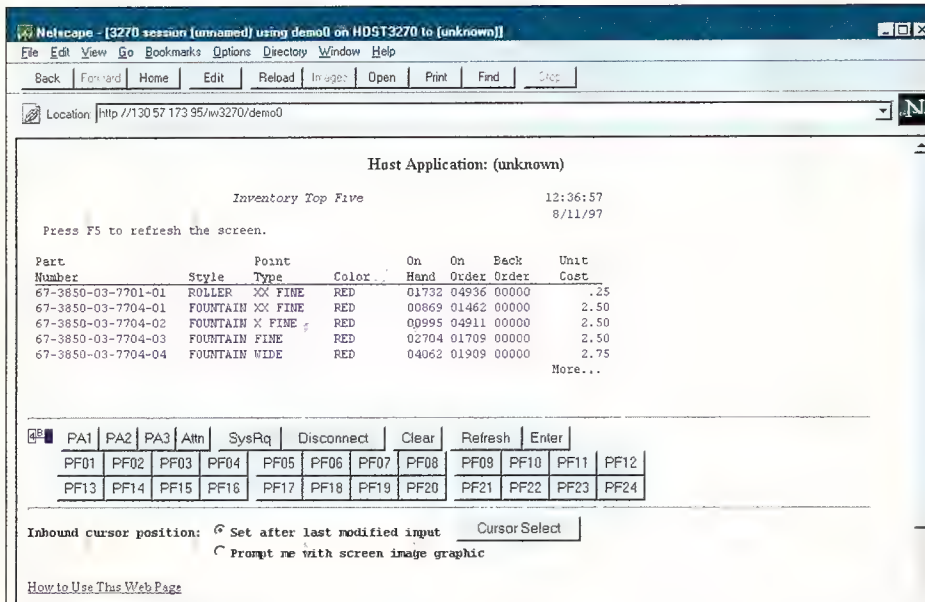


Figure 1. The standard screen for intraNetWare HostPublisher

of individual host sessions. Novell and IBM have also enhanced resolution capabilities for troubleshooting and performance problems in intraNetWare for SAA 3.

- **Improved SAA Management.** There are more ways to manage intraNetWare SAA 3 than any other SNA gateway. For example, you can manage intraNetWare for SAA 3 through a web browser, and you can configure intraNetWare for SAA 3 offline, without a direct, active connection to the gateway.

FAULT TOLERANCE AND LOAD BALANCING

intraNetWare for SAA 3 offers hot standby for mainframe environments, providing fault tolerance for mission-critical applications. You can designate an intraNetWare for SAA 3 gateway as a hot standby for other intraNetWare for SAA 3 gateways. If one of these gateways goes down or experiences a problem that prevents the gateway from responding to requests, the hot standby gateway immediately takes over, without your intervention. Users continue to

work uninterrupted, unaware a problem has occurred.

intraNetWare for SAA 3 also offers load balancing for mainframe environments, allowing you to better utilize your company's resources. intraNetWare for SAA 3 can distribute host sessions across multiple gateways. Using an intelligent algorithm, intraNetWare for SAA 3 calculates the number of sessions each server is handling and then creates a table of servers and their load factor. (The load factor defines the number of sessions a particular gateway is handling.) When a client requests a new session, the server that is least busy (with the lowest load factor) provides the session.

Although previous versions of intraNetWare for SAA offered hot standby and load-balancing, intraNetWare for SAA 3 uses Service Location Protocol (SLP) to provide these capabilities in a TCP/IP environment.

WEB-TO-HOST CONNECTIVITY

To many people today, the word *client* means web client. intraNetWare for SAA 3 allows you to connect your company's mainframe or AS/400 server to the Internet. After making this connection, you can use third-party software to publish data from the mainframe or AS/400 server to Internet users. One way to publish this data is intraNetWare HostPublisher, a server-based 3270-to-HTML converter. To use intraNetWare HostPublisher, you must have intraNetWare for SAA 3 and web server software running on an intraNetWare or NetWare 4.11 server.

intraNetWare HostPublisher makes it relatively easy to grant web clients access to mainframe applications, without converting the mainframe to TCP/IP. intraNetWare HostPublisher allows you to customize user profiles to control session resources such as the session pool, public sessions, dedicated sessions, or all sessions. Other options allow you to control display details and launch specific mainframe applications. (See Figures 1 and 2.)

For most SNA gateways, security for web clients is a mediocre username/password sequence requiring a separate database on the host. However, because intraNetWare for SAA 3 and intraNetWare HostPublisher are integrated with NDS, they provide three levels of security:

First, users log in and are authenticated to the NDS tree. If users have the necessary rights, they can then access intra-

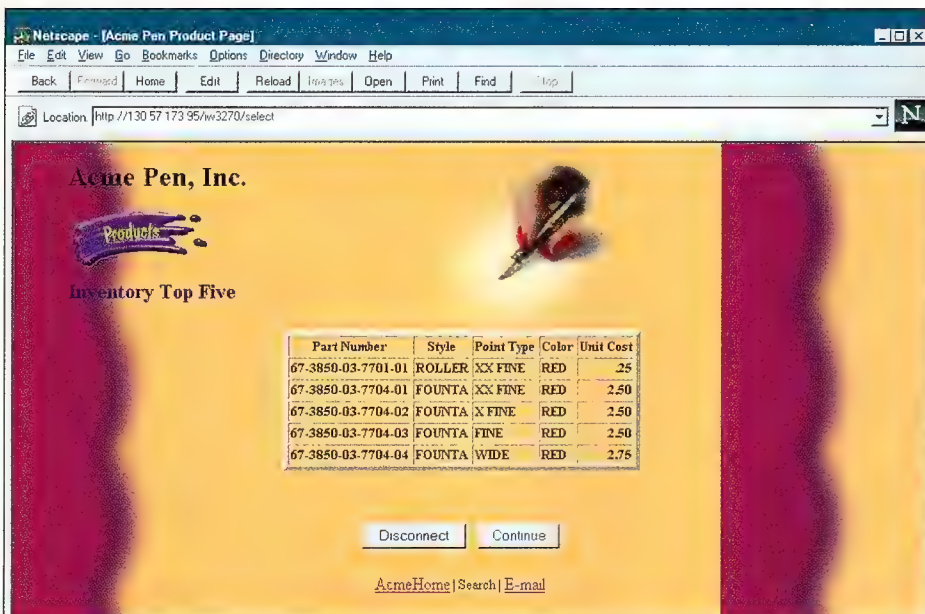


Figure 2. A customized screen for intraNetWare HostPublisher

NetWare HostPublisher, which is running on the intraNetWare for SAA 3 gateway. (See Figure 3 on p. 30.)

Second, once users establish a session, NDS uses Secure Socket Layer (SSL) 3 to encrypt data packets as they are transmitted over the Internet, preventing hackers from eavesdropping on the wire.

Third, intraNetWare HostPublisher ensures session integrity: If a user temporarily loses his or her link, intraNetWare HostPublisher ensures that this user receives the same session once the link is reestablished. intraNetWare HostPublisher also ensures that a user cannot take over another user's session.

Remote users, particularly users who travel, will find the combination of intraNetWare for SAA 3 and intraNetWare HostPublisher invaluable. Hotel rooms never have an SNA network connection, but they all have telephone lines. Using a web browser, remote users can now easily connect to a mainframe over the Internet.

Existing NetWare clients can take advantage of intraNetWare HostPublisher without waiting to convert to TCP/IP. An IPX/IP gateway, which is included with intraNetWare or is available from third-party companies such as FTP Software, provides a relatively simple means of granting IPX/SPX clients access to TCP/IP applications, such as web browsers, in a controlled and secure manner.

In addition, web application developers receive SAPI (Novell-designed low-level API) and High-Level Language API (HLLAPI) support. JavaScript is embedded inside HTML templates, paving the way to customized front-end displays for host applications. "Screen-scraping" applications, which pull data from particular fields on the host application and display these fields in different positions on the client, are supported in C, C++, and NetBasic.

intraNetWare HostPublisher is available in additive licenses, and each intraNetWare HostPublisher connection uses one intraNetWare for SAA 3 connection. For example, if your company had 270 mainframe users and 125 users who needed to access intraNetWare HostPublisher, you would need a total of 395 intraNetWare for SAA 3 concurrent users.

IMPROVED CLIENT SUPPORT

To help you manage the growing number of desktop operating systems on

your company's network, intraNetWare for SAA 3 supports the following:

- DOS
- Windows NT, Windows 98, Windows 95, and Windows 3.1
- UNIX
- OS/2
- Macintosh

Supporting more clients doesn't mean much unless those clients can do something useful. intraNetWare for SAA 3 supports the following communications:

- 3270, TN3270, and TN3270E.
- 5250 and TN5250.
- IBM's PC Support/400.
- Client Access/400.
- OS/2 Communications Manager.
- Third-party emulators from companies such as Attachmate, CONNECTronix, Dr. Materna, Eicon Technology, IBM, Memorex Telex, Wall Data, NetSoft/NetManage, Systems Strategies, Relay Technologies, Walker Richer Quinn (WRQ), and Zephyr Development.

(WRQ and Zephyr have emulators that support SLP in a TCP/IP environment.)

In addition, intraNetWare for SAA 3 includes a software developer's kit (SDK), which contains reference materials and sample programs to help you develop applications that use the Logical Unit 6.2 (LU6.2) protocol for session establishment and use Lux and the NetView interfaces for better management. The SDK includes standard APIs that support Advanced Program to Program Communications (APPC) and Common Programming Interface-Communications (CPI-C). CPI-C uses APPC verbs as the foundation for a common programming interface across IBM platforms.

IMPROVED COMMUNICATIONS

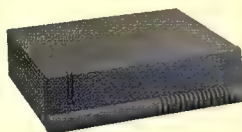
Despite the rush to Internet standards, more communications options are available today. intraNetWare for SAA 3 supports the following protocols:

- TCP/IP
- Token-Ring

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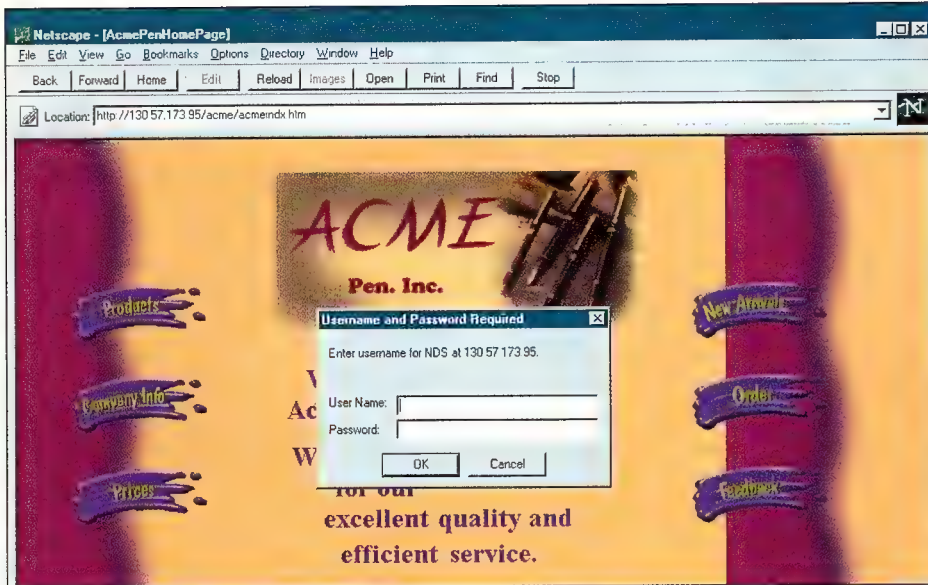


Figure 3. You must supply your NDS username and password to access host applications through intraNetWare HostPublisher.

- Ethernet
- Frame relay
- Fiber Distributed Data Interface (FDDI)
- Synchronous Data Link Control (SDLC)
- Qualified Logical Link Control over X.25 lines (QLLC/X.25)
- Channel attachments

ENHANCED SNA SUPPORT

intraNetWare for SAA 3 offers advanced peer-to-peer networking (APPN) node-based SNA routing capabilities, which provide host connections and LU allocation for downstream devices. PU concentration makes a downstream PU device appear to the intraNetWare for SAA 3 gateway as a PU. However, the host sees this device as an LU, thanks to intraNetWare for SAA 3. PU concentration reduces the number of PUs supported on the host, decreasing SNA management overhead.

The APPN support also provides High-Performance Routing (HPR), class of service routing, and nondisruptive routing, improving performance and ensuring uptime.

E-MAIL EVERYWHERE

One of the critical features for the new generation of SNA gateways identified by IDC is e-mail compatibility. Connecting to legacy, mainframe systems such as IBM's PROFS provides an excellent upgrade incentive. After all, users

have been complaining about PROFS for years, but you can't leave behind all the legacy data and control PROFS offers.

Using intraNetWare for SAA 3 as the connecting point, you can use Novell's GroupWise OfficeVision/VM Gateway 4.1 for OS/2 to provide messaging communication between GroupWise 5 and 4.1, IBM's OfficeVision, and PROFS. GroupWise 5 and 4.1 include NDS support, a critical component for e-mail integration. (For more information about the GroupWise gateway, visit <http://www.novell.com/groupwise/gateways/vision.html>.)

THE COMPETITION

Microsoft has lessened its rhetoric about replacing the mainframe, although the company may resurrect this story when Windows NT 5.0 gets closer to shipment. Moving its target a bit, Microsoft now aims to surround the mainframe with Windows NT servers. When comparing Windows NT SNA Server and intraNetWare for SAA 3, keep in mind the following:

- intraNetWare for SAA 3 leverages the power of NDS, which provides centralized management, remote management, and security. You can use the NWADMIN utility to manage intraNetWare for SAA 3 in the same way you manage other network resources.
- intraNetWare for SAA 3 provides real-time management capabilities.
- Upgrading earlier versions of NetWare for SAA is easy.

- intraNetWare for SAA 3 is integrated with NetView and other host management software systems.
- intraNetWare for SAA 3 provides hot standby and load balancing in a TCP/IP environment.
- intraNetWare for SAA 3 supports APPN and HPR, which provide high performance.

As you can see, NDS integration can simplify the management of your company's SNA gateway. With other SNA gateways, you must recreate and establish security profiles for all SNA gateway users. With intraNetWare for SAA 3, you can use NDS to quickly set up a new, secure SNA gateway.

Don't underestimate the time and savings NDS provides when coupled with intraNetWare for SAA 3. How many network administrators have the time to install a new product and create security profiles for all SNA gateway users? On the other hand, how many network administrators would it take to create a new Group object in NDS, add the access rights, and click once on each member of the group? Even in large companies, creating a new Group object for intraNetWare for SAA 3 can be measured in minutes to hours, rather than the days to weeks required by other SNA gateways.

CONCLUSION

intraNetWare for SAA 3 is the leading network client-to-host gateway available today. By leveraging the performance of the NetWare platform and the security of NDS, intraNetWare for SAA 3 offers a combination of speed, reliability, and control unmatched by other SNA gateways.

Until mainframes are dead (right after politicians become trustworthy and right before the sun runs out of energy), network clients will need SNA gateways. intraNetWare for SAA 3 connects network clients of all types to all IBM mainframe and AS/400 hosts.

For more information about intraNetWare for SAA 3, visit Novell's web site (<http://www.novell.com/products/host>.) You can also call 1-888-321-4272 in the United States and Canada and 1-801-228-4272 in other areas.

James E. Gaskin is a Dallas-area consultant and author specializing in networking technology. His latest NetWare book is *intraNetWare BorderManager* from Sybex. ●



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Moving to 100 Mbit/s

Mickey Applebaum

To users, speed is everything. When you add users and applications to the network, however, the amount of time it takes to process users' requests may increase, causing users to complain about poor performance.

One way to satisfy users' need for speed is to migrate your company's 10 Mbit/s Ethernet network to a 100 Mbit/s Ethernet network. However, you may not have the time or budget to migrate the entire network to 100 Mbit/s Ethernet at one time: After all, you will need to purchase and install new hubs, new network interface boards in each workstation, and maybe even new workstations to replace older ones that do not have PCI slots.

To ease the pain of migrating to 100 Mbit/s Ethernet, many vendors have released products that allow you to migrate the network in stages. This article explains the types of products you can use to gradually migrate from 10 Mbit/s Ethernet to 100 Mbit/s Ethernet. This article also describes two migration scenarios to help you plan the migration for your company's network.

TYPES OF PRODUCTS

To begin the upgrade process, you need a product that allows you to run 100 Mbit/s Ethernet segments while retaining some 10 Mbit/s Ethernet segments. Until recently, the only available solution was a 10/100 switch, which creates a separate segment for each port. Because each port is independent of every other port, the traffic passing through one port affects only that port. However, a dual-speed switch can be expensive: A 10/100 switch typically ranges in price from U.S. \$1,500 to U.S. \$5,000, depending on the number of ports you need.

You now have the option of installing a 10/100 hub instead. A dual-speed hub actually contains two hubs that are connected internally by a dual-port switch module: One hub runs 10 Mbit/s Ethernet, and the other hub runs 100 Mbit/s Ethernet. When a port establishes a connection at a particular speed, this port becomes part of the segment that includes every other port which has established a connection at the same speed. As a result, all of the ports running at the same speed are connected to the same internal hub, thus sharing a single segment to access the network.

For example, if four ports established a connection at 100 Mbit/s and six ports established a connection at 10 Mbit/s, a dual-speed hub would create two segments—one for each speed. All of the ports running at 100 Mbit/s would share one segment, and all of the ports running at 10 Mbit/s would share one segment. A dual-speed switch, on the other hand, would create 10 segments—one for each port—thus providing better performance than a dual-speed hub.

The main benefit of a dual-speed hub is the price. The following products show how much dual-speed hubs cost:

- You can purchase an eight-port CheetahHub from Accton Technology Corp. beginning at the suggested retail price of less than U.S. \$500. (For more information about the CheetahHub family of products, go to http://www.accton.com/accton/products/hubs/hub_index.html.)
- You can purchase a 12-port EZ Hub 10/100 from SMC Networks Inc. beginning at the suggested retail price of less than U.S. \$900. (For more information about the EZ Hub 10/100, go to <http://www.smc.com/network/hubs/ezhub10.html>.)

In addition to installing a dual-speed switch or a dual-speed hub, you need to install dual-speed network interface boards in each workstation that you want to operate at 100 Mbit/s. Almost all of the latest network interface boards are dual-speed network interface boards, capable of running either 10 Mbit/s Ethernet or 100 Mbit/s Ethernet.

Dual-speed network interface boards have been available for some time, but vendors have only recently offered these products at an affordable price. For example, SMC Networks just lowered the cost of its PCI-based EZ Card 10/100, which now has a suggested retail price of less than U.S. \$40. (For more information about EZ Card 10/100, go to <http://www.smc.com/network/lan/ezc100ds.html>.)

Because most dual-speed network interface boards are PCI based, you cannot install these network interface boards in older workstations that do not have PCI slots. If your company's network includes these workstations, you must replace them with new workstations that have PCI slots. Of course, if you have to replace workstations, the cost of running both 10 Mbit/s Ethernet and 100 Mbit/s Ethernet increases significantly.

MIGRATION SCENARIOS

Now that you know what products to purchase, you should know how to gradually move your company's network from 10 Mbit/s Ethernet to 100 Mbit/s Ethernet. You can use two migration scenarios to help plan the migration process. The first migration scenario features a small network with one server and 10 workstations, and the second migration scenario features a larger network with two servers and 50 workstations. Each migration scenario has different requirements to make the migration process seamless, without causing any network downtime.

These migration scenarios are based on the assumption that you are running a 10Base-T Ethernet network and that you are

using Category 5 unshielded twisted-pair cabling. Category 5 cabling is designed to support speeds of up to 100 Mbit/s, while Category 3 cabling is designed to support speeds of only 10 Mbit/s. Using cabling that is not designed to support the speed at which you are running can cause connectivity problems that prevent the network from functioning properly.

Migration Scenario for One Server and 10 Workstations

If your company's network had one server and 10 workstations, you would begin the migration process by replacing the existing 10 Mbit/s Ethernet hub with a 12- or 16- port dual-speed hub. You would simply swap cables from the old hub to the new hub.

After you had installed the dual-speed hub, you would replace the existing network interface board in the server and in each workstation you wanted to operate at 100 Mbit/s. You would then install and configure the new dual-speed network interface board. In most cases, you would run the configuration utility that comes with the network interface board and select the Auto option or the 100 Mbit/s option, depending on the available options.

Because a dual-speed hub automatically detects the correct speed for each connection established to the hub, some workstations could continue to run 10 Mbit/s Ethernet. As a result, you could keep the existing network interface board in these workstations, rather than installing a dual-speed network interface board.

Migration Scenario for Two Servers and 50 Workstations

If your company's network had two servers and 50 workstations, this network would include more 10 Mbit/s Ethernet hubs. In the past, you had to replace all of the 10 Mbit/s Ethernet hubs at once with 100 Mbit/s Ethernet hubs. With dual-speed hubs, however, you no longer have to replace all of the hubs at one time. You could implement dual-speed hubs in two ways, depending on where the existing 10 Mbit/s Ethernet hubs reside on your company's network:

- If the existing 10 Mbit/s Ethernet hubs were distributed throughout the network, you might want to purchase and install only one dual-speed Ethernet hub. You could then daisy-chain this

hub to each 10 Mbit/s Ethernet hub. With this configuration, you could gradually replace each 10 Mbit/s Ethernet hub with a dual-speed hub or with a 100 Mbit/s Ethernet hub. If some users did not need the extra speed, you could keep one or more 10 Mbit/s Ethernet hubs indefinitely for these users.

- If the existing 10 Mbit/s Ethernet hubs resided in a central location, such as in a server room, you might want to purchase and install a stackable dual-speed hub. Both of the dual-speed hubs mentioned earlier—Accton Technology's CheetaHub and SMC Networks' EZ Stack 10/100—are stackable, enabling you to add other dual-speed modules as necessary.

Most stackable dual-speed hubs offer anywhere from eight to 96 ports per module, providing a lot of flexibility in how you implement the migration process. When you were ready to replace a 10 Mbit/s Ethernet hub, you could simply purchase a dual-speed module with the number of ports you

needed. You could then add this module to the stackable dual-speed hub.

After you had implemented dual-speed hubs in one of these ways, you would replace the existing network interface board in the server and in each workstation you wanted to operate at 100 Mbit/s. You would then install and configure the new dual-speed network interface board.

CONCLUSION

By implementing dual-speed hubs and dual-speed network interface boards, even small companies without a huge networking budget can push the envelope to 100 Mbit/s. No matter the size of your company's network, dual-speed hubs and dual-speed network interface boards offer an easy, cost-effective alternative to single-speed products. As a result, you no longer have to let high-speed networking technologies pass you by.

Mickey Applebaum has worked with NetWare for more than 14 years. Mickey provides technical support on the Internet for The Forums (<http://theforums.com>). •

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Migrating to Pure IP

With NetWare 5

Unlike previous versions of NetWare, NetWare 5 can run over the IPX/SPX stack, the TCP/IP stack, or both. Previous versions of NetWare depend on the IPX/SPX stack for NetWare Core Protocol (NCP) services, such as file reads and writes, user login and authentication, and Novell Directory Services (NDS) synchronization. Because customers wanted to implement TCP/IP-only networks, Novell developed pure IP, which offers NCP services natively over the TCP/IP stack.

The terms *native* and *pure* imply that encapsulation is not required. In NetWare 5, pure IP allows NCP to sit directly on top of User Datagram Protocol (UDP) or Transmission Control Protocol (TCP) headers and use IP services for discovery, addressing, and data-transfer operations. With NetWare/IP, however, IPX packets are encapsulated within UDP/IP headers.

To help companies migrate to pure IP or to configure a network that supports both IPX/SPX and TCP/IP, NetWare 5 offers the following three options:

- Compatibility mode server process
- Compatibility mode client process
- Migration agent

(Want to know what the woman on this page is saying? Visit the *NetWare Connection* World-Wide Web site to find out! Simply go to <http://www.nwconnection.com>, and click the Advertisers button.)

COMPATIBILITY MODE SERVER PROCESS

By default, the compatibility mode server process runs on every NetWare 5 server to support any server-based applications that are IPX dependent. This process translates IPX communications—such as Service Advertising Protocol (SAP) queries, SAP broadcasts, and IPX packets—into the pure IP

format. For example, suppose that a NetWare Loadable Module (NLM) relied on SAP broadcasts to announce its presence on the network, enabling workstations to discover this NLM. If you had a pure IP network, you would not want NLMs transmitting SAP traffic.

The compatibility mode server process would redirect SAP broadcasts to the Service Location Protocol (SLP) process running on the NetWare 5 server. The SLP process would register the IPX-dependent NLM, enabling workstations to discover this NLM just as they discover IP services. The NLM would be unaware that its service announcement had been redirected. (See Figure 1. For more information about SLP, see "Service Location Protocol: Discovering Services in a Pure IP Environment," *NetWare Connection*, July 1998, pp. 32–37. You can download this article from <http://www.nwconnection.com/jul.98/slp78>.)

COMPATIBILITY MODE CLIENT PROCESS

By default, the compatibility mode client process runs on all NetWare 5 clients. This process ensures that IPX-dependent applications running on NetWare 5 clients transmit only IP communications.

For example, if a printer driver were IPX dependent and required a SAP broadcast to locate a print server, the compatibility mode client process would change this SAP query to an SLP query. (See Figure 2 on p. 36.)

MIGRATION AGENT

The migration agent enables you to maintain a mixed IPX and IP network, providing a gateway between two environments: NCP-IPX and NCP-IP. The migration agent enables users on a pure IP network to access services located on an IPX network. Likewise, the migration agent enables users on an IPX network to access services located on a pure IP network.



Figure 3 shows how you can use the migration agent to connect an IPX network and a pure IP network. (See p. 36.) The FS1 server on the pure IP network is running NetWare 5, and both the server and the client are configured to support only NCP over IP. Although the IPX stack is not loaded on the server or the client on the pure IP network, both the server and the client are running the compatibility mode process. The FS2 server on the IPX network could be running NetWare 2, NetWare 3, NetWare 4, or NetWare 5 (configured to support only NCP over IPX).

To enable these two networks to communicate with one another, the company has loaded the migration agent on a NetWare 5 server, which is acting as a gateway between the two networks. The migration agent provides protocol translation services, changing IPX-based queries into pure IP-based queries. As a result, Jillian on the IPX network could access services that resided on the pure IP network. (See Figure 3 on p. 36.)

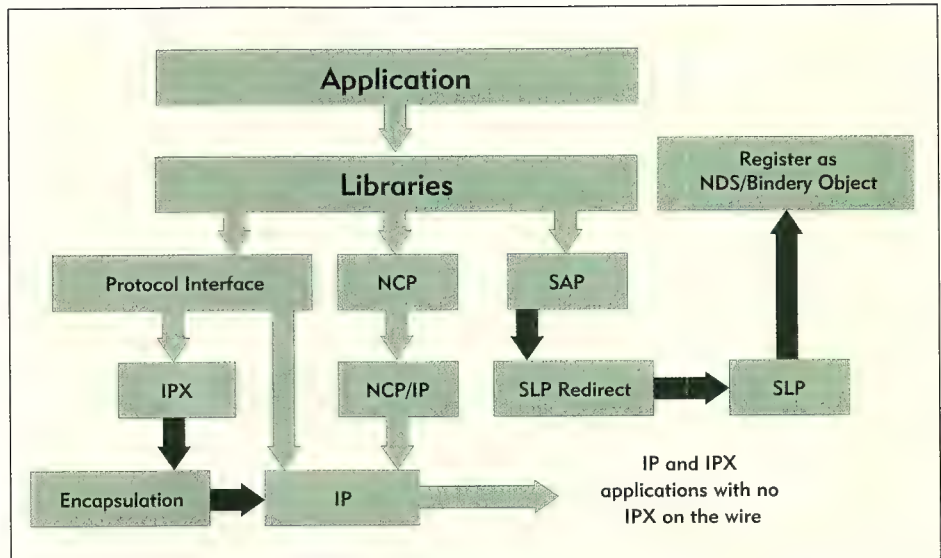


Figure 1. The compatibility mode server process allows you to run IPX-dependent NLMs on a pure IP network.

Configuration Options

The SCMD NLM provides both the compatibility mode server process and the migration agent. Although the com-

patibility mode server process is enabled by default, you must manually enable and configure the migration agent. To enable the migration agent, you load the SCMD

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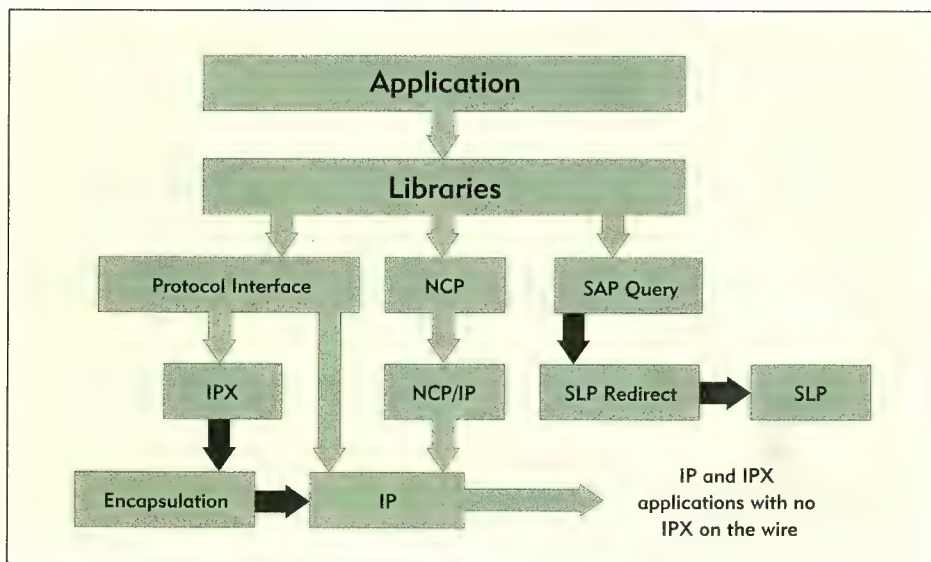


Figure 2. The compatibility mode client process allows users to run IPX-dependent applications on their workstations.

NLM reentrantly by entering one of the following commands:

LOAD SCMD.NLM /G

You would use the /G option if you wanted to configure a migration agent to connect one IPX network and one pure IP network. (See Figure 3.)

LOAD SCMD.NLM /BS

You would use the /BS option if you wanted two disconnected IPX networks to communicate through a pure IP network, as shown in Figure 4. In this case,

you would use the /BS option to configure a migration agent for both IPX networks, enabling these migration agents to exchange SAP and Routing Information Protocol (RIP) information about the disconnected IPX networks.

In Figure 4, for example, two disconnected IPX networks are communicating through the IP-based Internet. If you loaded the SCMD NLM with the /BS option, the migration agents would encapsulate IPX packets inside IP, thus enabling these disconnected IPX networks to communicate.

Because most companies will probably load the SCMD NLM with the /G op-

tion to connect an IPX network directly to a pure IP network, the remainder of the article focuses on this configuration.

THE MIGRATION AGENT IN ACTION

The migration agent performs the following five functions:

- Registers migration agent services with an SLP service agent. (An SLP service agent works on behalf of a service to respond directly to queries for specific services. For more information about SLP service agents, see "Service Location Protocol," *NetWare Connection*.)
- Registers SAP services with an SLP service agent.
- Unencapsulates and forwards SAP queries to an IPX network.
- Unencapsulates and forwards RIP queries to an IPX network.
- Encapsulates and unencapsulates IPX traffic that is coming from or going to a pure IP network.

Registering Migration Agent Services With an SLP Service Agent

A migration agent registers its services with a local SLP service agent, making these services available to devices on the pure IP network. In Figure 3, for example, the migration agent would register its services with the FS1 server.

Sometimes a NetWare 5 client running the compatibility mode client process might require the services of the migration agent. In this case, the NetWare 5 client would use SLP to discover the migration agent.

Registering SAP Services With an SLP Service Agent

As the translator between an IPX network and a pure IP network, a migration agent receives SAP broadcasts from the IPX network. For example, the FS2 server in Figure 3 would send a SAP broadcast every 60 seconds on the IPX network, announcing the server's file, directory, and other services. After receiving this SAP broadcast, the migration agent would send an SLP packet to the SLP service agent, registering the server's services.

If a NetWare 5 client running the compatibility mode client process wants to use an IPX service, this client sends an SLP query to the SLP service agent. The SLP service agent then returns the network address of the device providing the requested IPX service.

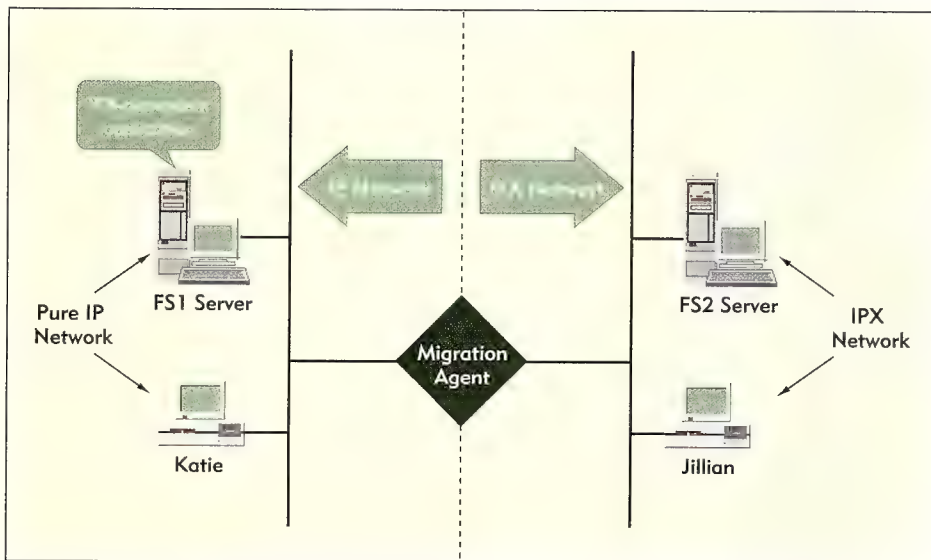


Figure 3. The migration agent allows users on a pure IP network to use the resources on an IPX network, and vice versa.

Unencapsulating and Forwarding SAP Queries to an IPX Network

If a NetWare 5 client running the compatibility mode client process queries an SLP service agent for an IPX service and that service is not registered with the SLP service agent, this client can encapsulate a SAP query inside IP and send the query directly to the migration agent. The migration agent, in turn, unencapsulates the SAP query and forwards it to the IPX network. The migration agent then encapsulates the SAP reply inside IP and sends this reply to the requesting NetWare 5 client.

Unencapsulating and Forwarding RIP Queries to an IPX Network

After a NetWare 5 client running the compatibility mode client process locates an IPX service, this client encapsulates a RIP query inside IP and sends the query directly to the migration agent. Next, the migration agent unencapsulates the RIP query and forwards it to the IPX network. The migration agent then encapsulates the RIP reply inside IP and sends this reply to the requesting NetWare 5 client.

Encapsulating and Unencapsulating IPX Traffic

If a NetWare/IP client exists on a pure IP network, the migration agent can unencapsulate IPX packets and forward them in native IPX format to the IPX network. For example, if a NetWare/IP client resided on a pure IP network, this client would encapsulate IPX packets within a UDP/IP header.

When a NetWare/IP client needs to locate a service on an IPX network, the client sends a SAP request to the migration agent. The migration agent then unencapsulates the SAP request and sends it in its native IPX format onto the IPX network.

CONCLUSION

NetWare 5 offers several options to help you migrate your company's network from IPX to pure IP. The compatibility mode processes allow you to run IPX-dependent NLMs and applications on a pure IP network. The migration agent translates protocols between a pure IP network and an IPX network. As a result, you can continue to use IPX-dependent NLMs and applications and you can migrate some segments of your company's

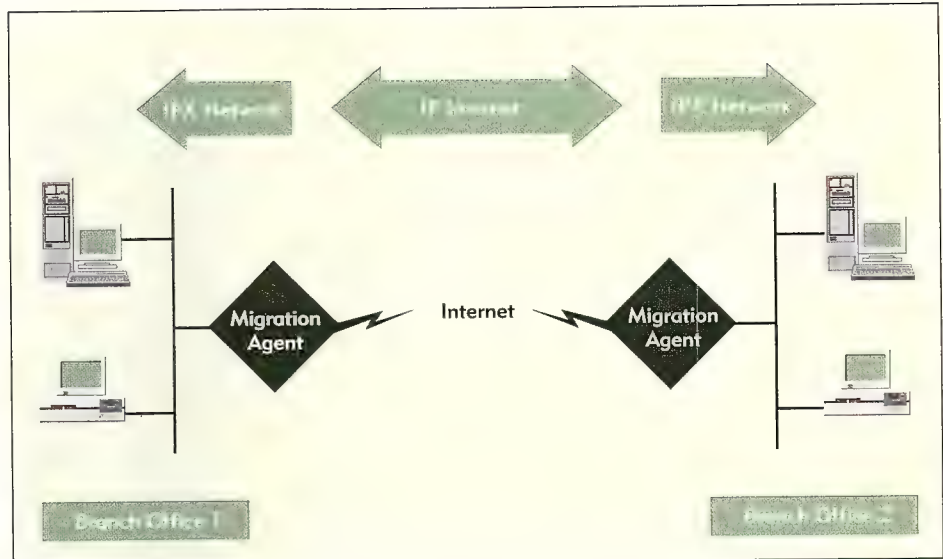


Figure 4. By using the LOAD SCMD /BS command, you can configure disconnected IPX networks to communicate through an IP backbone, such as the Internet.

network to pure IP while maintaining IPX on other segments. Users on the IPX network can then continue to use services on the pure IP network, and vice versa.

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Backing Up the NetWare File System

Mickey Applebaum

Editor's Note: "Technically Speaking" answers your technical questions, focusing on network management issues. To submit a question for a future column, please send an e-mail message to nwc-editors@nwconnection.com, or send a fax to 1-801-228-4576.

An intraNetWare or NetWare 4 server contains two components that you must back up: Novell Directory Services (NDS) and the NetWare file system. Because these components perform different functions, each component has a unique set of backup requirements, which you must follow to ensure that you can fully restore the component in the event of a server failure.

The last issue of *NetWare Connection* featured an article about backing up NDS. (See "Technically Speaking: Backing Up NDS," *NetWare Connection*, Aug. 1998, pp. 43–45. You can download the article from <http://www.nwconnection.com/aug.98/techsp88>.) The following article focuses on backing up the file system.

UNDERSTANDING THE NETWARE FILE SYSTEM

Before you begin the backup, you should understand the type of information the NetWare file system contains and the file system information you need to back up. Obviously, the NetWare file system contains the files and directories stored on each volume. However, the NetWare file system also contains other critical information. Because many network administrators are not aware of this additional information, they mistakenly back up only the files and directories stored on the server, assuming that they have a complete backup of the NetWare file system.

For example, many network administrators think that file and directory trustee rights are part of NDS—not the NetWare file system. Actually, trustee rights are stored on each volume, so they must be backed up with the NetWare file system. The confusion may arise because you must restore User objects, which are part of NDS, before you restore trustee rights, which are part of the file system. (Because trustee rights are specific to users, you cannot restore these rights until User objects reside on the server.)

A similar misconception exists for file and directory ownership information: Although file and directory ownership information is specific to users, this information is part of the NetWare file system rather than NDS. In addition, the NetWare file system contains extended file attribute information, which includes file and directory flags such as Purge, Delete Inhibit, Copy Inhibit, Shareable, Last Accessed, and Last Modified.

The NetWare file system also contains information about size restrictions for both volumes and directories, as well as in-



formation about each volume's name spaces. For example, the NetWare file system contains long filename information for Windows NT, Windows 98, Windows 95, OS/2, Macintosh, and Network File System (NFS) name spaces.

To make a reliable backup, you must ensure that you have an error-free NetWare file system. If you suspect that the NetWare file system contains errors or that the volume tables are corrupted, you should run Novell's VREPAIR utility on each volume on the server. However, you should run the VREPAIR utility only if you believe a problem exists in the NetWare file system: Because the VREPAIR utility has such a powerful effect on volumes, you should not use this utility as a preventive maintenance tool. In other words, do not automatically run the VREPAIR utility before you make each backup.

Novell recommends that you always use the latest version of the VREPAIR utility and the associated name space NetWare Loadable Modules (NLMs)—the V_MAC NLM, the V_LONG NLM, and the V_NFS NLM. You can find the latest version of the VREPAIR utility and the associated name space NLMs in Novell's intraNetWare Support Pack. (As we go to press, the latest version is intraNetWare Support Pack 5.0, which you can download from <http://support.novell.com/misc/patlst.htm>.)

INSTALLING BACKUP HARDWARE AND SOFTWARE

Before you begin the backup process, you should also ensure that you are using a tape drive and backup software that have been tested and certified by Novell to work with an intra-NetWare or NetWare 4 server and Novell's Storage Management Services (SMS). SMS is an open architecture that defines how storage management products, such as Novell's SBACKUP utility and third-party backup software, access and store information for backup and restore purposes. You can find out more about SMS by reading the following articles:

- "Storage Management Services," *NetWare Connection*, Sept. 1996, pp. 6–22. You can download this article from <http://www.novell.com/nwc/sep.96/sms96>.
- "Overview of SMS and NDS," *Novell Application Notes*, Aug. 1995, pp. 1–50. You can download this article from

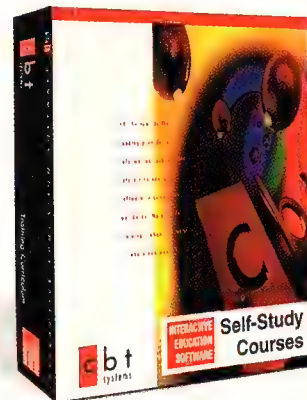
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Types of Backup Jobs

When you create a backup job, you may be prompted to specify the type of backup job you want to create. Although the options vary depending on the backup software you are using, most backup software offer the following options:

- **Complete Backup.** If you select this option, the backup software backs up all files in all directories stored on the server or volume you specify or in the directory you specify, regardless of when the last backup was made and whether the files have already been backed up. NetWare then changes the Archive file attribute to indicate that the files have been backed up. To ensure that the Archive file attribute is being changed, you should check this attribute after the backup is completed.
- **Incremental Backup.** If you select this option, the backup software backs up only files that have been created or modified since the last backup was made. When you create or modify a file, NetWare automatically sets the Archive file attribute to Not Backed Up. If you make an incremental or a differential backup, the backup software determines which files need to be backed up by checking the Archive file attribute and backing up all files with the Not Backed Up setting. After the backup software backs up these files, NetWare changes the Archive file attribute to indicate that the files have been backed up.
- **Differential Backup.** If you select this option, the backup software backs up only files that have been created or modified since the last backup was made—just as with an incremental backup. The difference between an incremental backup and a differential backup is NetWare does not change the Archive file attribute after the differential backup is completed. Instead, the files maintain their Archive file attribute setting of Not Backed Up. These files continue to be backed up during each subsequent differential backup, until the next complete backup occurs.

When the next complete backup occurs, NetWare changes the Archive file attribute to indicate that the files have been backed up. As a result, these files are no longer included in each subsequent differential backup.

Differential backups offer a significant benefit when you are performing the restore process: Because each differential backup includes all of the files that have been modified since the last complete backup was made, you need to restore the server only from the last complete backup and the last differential backup.

Differential backups also offer a significant drawback: Because each differential backup includes all of the files that have been modified since the last complete backup was made, differential backups can take a long time to make. The longer the time since you made the last complete backup, the more files you have to back up as part of each differential backup.

If possible, you should make a complete backup every day, and you should configure this backup to overwrite the backup tape you are using. In this way, you can ensure that you always have the most recent files on hand, which you can then restore in the event of a server failure. For example, if you made a complete backup every night and the server failed on Wednesday, you could use the backup tape from Tuesday to do a complete restore.

If you cannot make a complete backup every day, you should make an incremental or a differential backup. For example, you might want to make a complete backup on Friday night, backing up all of the files for the week. You could then make incremental backups Monday through Thursday.

When you make an incremental or a differential backup, you should use the backup tape that contains the last complete backup and append the incremental or the differential backup to that complete backup. In the event of a server failure, you could then simply restore the server by using the complete backup from Friday night and each of the incremental backups from Monday through Thursday, thus ensuring that you have performed a complete restore.

If your tape drive does not provide enough storage capacity to append an incremental backup to the last complete backup on a single backup tape, you should make a differential backup instead. For example, you could make a complete backup on Friday night and then make differential backups Monday through Thursday. You could then use one backup tape for the last complete backup and another backup tape for all of the differential backups. ●

<http://developer.novell.com/research/appnotes/1995/august/01/02.htm>.

LOADING TARGET SERVICE AGENTS AND BACKUP SOFTWARE

In addition to installing backup hardware and software, you need to load the appropriate backup target service agent (TSA) at the server console. TSAs serve as an interface between the server and the backup software you are using, allowing this software to access NetWare services. Novell makes each NetWare service, such as the NetWare file system or NDS, available to SMS-compliant backup software via a corresponding TSA.

Novell's TSA410 NLM allows you to back up the NetWare file system. If you do not load this NLM, you can back up

only the files and directories stored in the NetWare file system and the DOS name space directory structure. (Novell recommends that you use the latest version of the TSA410 NLM, which is included in intraNetWare Support Pack 5.0. You can download intraNetWare Support Pack 5.0 from <http://support.novell.com/misc/patlst.htm>.)

To load the TSA410 NLM, enter the following command at the server console:

```
LOAD TSA410
```

You enter a similar command to load the backup software you installed. For example, if you were using the SBACKUP utility, you would enter the following command at the server console:

```
LOAD SBACKUP
```

PERFORMING THE BACKUP PROCESS

You are now ready to perform the backup process. Because each backup product provides a unique interface to identify backup tasks, this section includes general instructions that may not apply exactly to the backup software you use. You should be familiar with the particular backup software you have installed before you perform the backup process.

To perform the backup process, you complete three basic steps:

- Specify the information you want to back up.
- Create a backup job.
- Schedule the backup job.

The main screen for your backup software lists the type of backup and restore tasks you can perform. From this main screen, you select the option that allows you to perform the backup process.

The backup software should then display another screen, listing available backup sources. This screen identifies the servers on your company's network. You can highlight the server you want to back up, or if you are using Windows-based backup software such as Computer Associates' ARCserve or Seagate Software's Backup Exec, you can double-click the server's icon. You can also select individual files or volumes if you do not want to back up the entire server.

In most cases, you would select a server as the backup source. Depending on the backup software you have installed, you may be prompted to enter a username and password that this backup software can use to log in to the server and access the NetWare file system. You should enter a username that has ADMIN rights to the NDS tree or SUPERVISOR rights to the server you are backing up.

As you know, NDS rights and file system rights are not the same thing: You can have SUPERVISOR rights to the NetWare file system, without having ADMIN rights to the NDS tree. This distinction allows you to control the backup process.

For example, suppose that your company's network contained multiple servers and you wanted to back up NDS only from the server that contains the master replica of the NDS tree. To prevent you or another network administrator from inadvertently backing up NDS from other servers, you could create a User object that had SUPERVISOR rights to the NetWare file system on each server. You could also make sure this User object had no rights to the NDS tree. Then you would log in as this User object to back up the NetWare file system on each server.

After you select a backup source, you may be prompted to specify the type of backup job you want to create. (See "Types of Backup Jobs.") You create a backup job by defining the backup tasks you want to perform. Your backup software should include options that allow you to specify whether you want to back up file and directory trustee rights, file and directory ownership information, volume and directory size restrictions,

name space information, and so on. To make a reliable backup, you must select every available option. If you skip an option and you have to restore the NetWare file system from the backup you created, critical file system information may not be properly restored. As a result, users may not be able to access their files or their own home directories.

At this point, you can customize the backup job by defining optional backup tasks. For example, you can apply filters that prompt the backup software to exclude certain things, such as .TMP files, from the backup. You can also configure the backup software to use one of the following verification methods:

- **Full Verification.** If you select this option, the backup software compares each file written to the backup tape against the original file stored on the server. This option is the best one, ensuring that every file is properly backed up.
- **Partial Verification.** If you select this option, the backup software compares random files written to the backup tape against the original files stored on the server. If these files match, the backup software assumes that all of the files written to the backup tape are backed up properly.
- **Cyclic Redundancy Check (CRC).** If you select this option, the backup software compares the parity information on the backup tape against the parity information on the server. If this information matches, the backup software assumes that all of the files written to the backup tape are properly backed up. This option provides the simplest, but least reliable, type of verification.

Although verifying the backup is optional, you should use this option to ensure that you have made a complete backup. Otherwise, you won't know if all of the file system information is included in the backup until you try to restore the NetWare file system from this backup in the event of a server failure.

After you have created a backup job, you select the backup target, which is the tape drive you are using. You then have the option of submitting the backup job immediately or scheduling the backup job to be performed later. If you select the scheduling option, you must specify the date and time at which you want the

backup process to occur. You can also configure the backup software to automatically perform this process on a regular basis, such as every evening.

PERFORMING THE RESTORE PROCESS

Before you restore the NetWare file system, you must complete certain steps to recreate this file system in its exact state before the server failed. First, you repair or replace whatever made the server fail, and you reinstall intraNetWare or NetWare 4. You then restore NDS, ensuring that each User object is intact. (See "Technically Speaking: Backing Up NDS," *NetWare Connection*.)

Next, you must install the backup hardware and software you are using and load both the TSA410 NLM and the backup software at the server console. Once you can access the backup hardware and software, you can restore the NetWare file system.

To perform the restore process, you complete three basic steps:

- Specify the information you want to restore.
- Create a restore job.
- Schedule the restore job.

From the main screen of your backup software, you select the option that allows you to perform the restore process. At this point, you insert into the tape drive the backup tape that contains the latest complete backup you made, and you select the option to build a catalog of the information, or *dataset*, that can be restored from this backup tape. The backup software then scans the backup tape and builds the catalog.

After the catalog is completed, you create a restore job by selecting a dataset based on the date and time or on the name, depending on your backup software. You should select the latest complete backup dataset to restore the NetWare file system. If you performed an incremental or differential backup after the complete backup, you skip these datasets for now. You must first restore the NetWare file system from the latest complete backup dataset. (To learn the difference between full, incremental, and differential backups, see "Types of Backup Jobs.")

You are then prompted to specify a restore target by selecting the same server or volume from which you backed up the NetWare file system. Next, you

select the file system information you want to restore. The backup software you are using should include options for restoring only files and directories with particular attributes or flags; file and directory trustee rights; file and directory ownership information; volume and directory size restrictions; name space information; and so on. To completely restore the NetWare file system, however, you select the option that allows you to restore all of the file system information.

You can then customize the restore job by defining optional restore tasks, which are similar to the optional backup tasks you can define when creating a backup job. For example, you can select files or directories to exclude from the restore process, and you can set verification rules. Verifying that you have restored all of the file system information is optional but highly recommended.

At this point, the backup software should prompt you to specify an action that should be taken when a file or directory to be restored already exists on the server. Depending on the backup software you are using, you should see options similar to the following:

- **Overwrite All Files.** If you select this option, the backup software overwrites any file that already exists on the server with the same file stored on the backup tape. You should select this option only if you are sure that you need the exact files stored on the backup tape.
- **Overwrite Only Older Files.** If you select this option, the backup software overwrites files that already exist on the server only if the same files stored on the backup tape have a newer date and time. In most cases, you should select this option, which ensures that the latest version of each file is restored.
- **Ask Prior to Overwriting Files.** If you select this option, the backup software stops whenever it encounters a file that already exists on the server. You must then prompt the backup software to overwrite the file or to skip the file without restoring the backup file. If you are restoring a large number of files, you should not select this option because it requires extra time and intervention.
- **Overwrite None.** If you select this option, the backup software does not overwrite any file that already exists on the server. You should select this option

if you want to restore only files that do not already exist on the server.

After you select one of these options, you can submit the restore job immediately, or you can schedule the restore job to be performed later. In most cases, you should submit the restore job immediately so you can monitor its progress and detect any errors that may occur.

If you created an incremental or a differential backup in addition to a full backup, you should restore these datasets in the same way that you restored the complete backup dataset. Users should then be able to access the server, along with all of the file system information you just restored.

CONCLUSION

Although this article has covered the backup and restore processes in detail, you should be aware of some additional points before you begin these processes:

- Most backup software cannot back up open files. As a result, you should ensure that users exit their applications and log out of the network before the backup process starts. Although some backup software allows you to force users' connections off of the network, doing so may cause file corruption.
- To avoid these problems, you can use backup software that supports open files, including Open File Manager from St. Bernard Software Inc. and ARCserve with Backup Agent for Open Files from Computer Associates Inc. However, you should not rely exclusively on this type of backup software until you test it.
- Client-server database applications running on the server—including Oracle, Sybase, and Btrieve, as well as GroupWise and other applications that use a database—can also open files. To ensure that these files are included in the backups you make, you should follow the vendors' recommendations for backing up open database files. In addition, you should schedule a regular backup when the database application is shut down, providing the backup software with full access to database files.

Many database applications include a feature that allows you to save open database files as a single archive file, which you can then back up. You can

also use a separate utility designed for backing up open database files. If you wanted to back up open GroupWise database files, for example, you could use Novell's GWBACKUP and DB-COPY utilities. (See "Practical Networking: Backing Up Open GroupWise Database Files," *NetWare Connection*, July 1998, pp. 38–44. You can download this article from <http://www.nwconnection.com/jul.98/pracnt78>.)

- To be on the safe side, you should set up a server in a separate NDS tree, and you should use this server to periodically test the backup hardware and software you are using, as well as the backup tapes you have made. In this way, you can determine whether the backup hardware and software is functioning properly and whether the backup tapes contain reliable backups.
- You should also use this server to periodically test the restore process using one of the backup tapes. To ensure that this tape contains a complete backup, you should compare the restored file system and NDS information to the file system and NDS information you backed up.

By following the steps outlined in this article and in the previous article in the series, you should be able to properly back up and restore an entire intraNetWare or NetWare 4 server. You can then recover from a server failure or a disaster without losing critical server information.

If you want more information about backing up the NetWare file system, read the following articles:

- "Backup Solutions: A Practical Example," *Novell Application Notes*, Jan. 1998. You can download this article from <http://developer.novell.com/research/appnotes/1998/january/anframe.htm>.
- "NDS Technical Overview: Novell Layered Services," *Novell Developer Notes*, Aug. 1997, p. 46. (The "Directory TSA" section covers backup and restore issues.) You can download this article from <http://developer.novell.com/research/devnotes/1997/august/a9frame.htm>.

Mickey Applebaum has worked with NetWare for more than 14 years. Mickey provides technical support on the Internet for *The Forums* (<http://theforums.com>). ●

LogicSource for NDS

Novell recently announced the release of LogicSource for NDS, a technical support resource for Novell Directory Services (NDS). LogicSource for NDS provides a dictionary of error codes and explains why NDS errors occur and how to avoid them. LogicSource for NDS also provides detailed explanations of NDS concepts, processes, and operations. For example, LogicSource for NDS explains how to design and set up an NDS tree.

LogicSource for NDS is designed for NetWare 4 networks. A future release will include NDS information for NetWare 5 networks. For more information about LogicSource for NDS, visit Novell's World-Wide Web site at <http://support.novell.com/logicsource/nds>. You can also call 1-888-321-4272 or 1-801-228-4272.

GroupWise 5.5 Upgrade Window

Although Novell has announced GroupWise 5.5, you don't need to wait until this new version ships to purchase GroupWise 5.2 or to upgrade your company's GroupWise messaging system. If you purchase GroupWise 5.2 or if you upgrade GroupWise 4.1a or GroupWise 5.2 licenses between July 20, 1998, and 30 days after GroupWise 5.5 ships, you will be eligible to receive an equal number of GroupWise 5.5 licenses for only the cost of shipping and handling.

To receive the GroupWise 5.5 licenses, you must submit a valid proof of purchase. For more information about this upgrade program, visit Novell's web site at <http://www.novell.com/groupwise>.

ManageWise 2.6

Novell recently announced the availability of ManageWise 2.6, a standards-based network management product for mixed NetWare and Windows NT environments. ManageWise 2.6 anticipates potential network problems and uses Simple Network Management Protocol (SNMP) alarms to alert you of these problems.

ManageWise 2.6 includes the following new features:

- NetWare 5 support
- Management console support for Windows NT and Windows 98
- NDS monitoring
- Tighter integration with Novell's Zero Effort Networks (Z.E.N.works)
- New alarms for improved management of NetWare servers
- Enhanced network traffic analysis, including support for Fiber Distributed Data Interface (FDDI) and new decodes for IP-specific protocols such as Service Location Protocol (SLP) and Dynamic Host Configuration Protocol (DHCP)
- Improved custom maps that allow you to tailor the network view to reflect your company

- Improved performance for autodiscovery of the network
- Enhanced virus protection

In addition, ManageWise 2.6 is year 2000 ready. For more information about ManageWise 2.6, visit Novell's web site at <http://www.novell.com/managewise>. You can also call 1-888-321-4272 or 1-801-228-4272.

GroupWise Gateway for Microsoft Exchange

Novell recently announced a GroupWise gateway for Microsoft Exchange. This gateway transports and converts messages to and from the GroupWise and Microsoft Exchange formats, allowing users to exchange messages and information seamlessly between the two messaging systems. For example, an Exchange user can receive an appointment from a GroupWise user, and this appointment will be translated into the Exchange format.

The GroupWise gateway for Microsoft also synchronizes the GroupWise user list with the Exchange user list. When a user is added, modified, or removed from GroupWise, the change is immediately sent to Exchange. In addition, the GroupWise gateway for Microsoft allows you to transfer Exchange users to GroupWise, without causing downtime. The GroupWise gateway for Microsoft Exchange runs on Windows NT and supports GroupWise 5.2 or higher.

In addition to providing this gateway, Novell offers GroupWise gateways for Lotus cc:Mail and Lotus Notes. Novell also provides a separate migration utility for Microsoft Mail. You can download these GroupWise gateways free from Novell's web site at <http://www.novell.com/download>. For more information about GroupWise, visit Novell's web site at <http://www.novell.com/groupwise>. You can also call 1-888-321-4272 or 1-801-228-4272.

Novell, Eicon Agreement

Novell and Eicon Technology recently announced an agreement to sell Eicon's high-performance WAN adapters under Novell's red box brand. As a result of this agreement, Novell's red box products will now include EiconCard P62 for NetWare and EiconCard P92 for NetWare WAN adapters, which are designed for use with NetWare, intraNetWare, intraNetWare for SAA, and BorderManager. Because these WAN adapters support Frame Relay, X.25, and Point-to-Point Protocol (PPP) connections over leased or dial-up lines, you can install these adapters in any NetWare server, regardless of the connection type. In addition to these network interface boards, all of Eicon's P-class WAN drivers will be included with NetWare 5.

For more information about Eicon's WAN network interface boards, visit Eicon's web site at <http://www.eicon.com>.

NUI Technical Conferences

From East to West

Peta Saayman and Emily Johnson

Keeping up with the constantly changing world of network technology is no small task. To help you keep up-to-date, NetWare Users International (NUI) sponsors technical conferences that provide valuable training and hands-on experience. This year, NUI sponsored conferences in cities on both sides of the globe, from the Technical Tour in Australia, New Zealand, and Asia to the InterConnect '98 conferences in North America.

AUSTRALIA/ASIA: THE TECHNICAL TOUR

The Technical Tour was a full-day event designed to meet the needs of network administrators, MIS managers, help-desk staff, and systems integrators. During June, the Sydney NetWare Users Group, the South East Queensland NUG Inc., the South Australian NetWare User Group, and the Melbourne NetWare User Group sponsored the Technical Tour in the following cities:

- Adelaide, Australia
- Melbourne, Australia
- Perth, Australia
- Brisbane, Australia
- Sydney, Australia
- Auckland, New Zealand

The Technical Tour opened with an introductory presentation of new Novell products, including the upcoming releases of BorderManager, GroupWise, and Novell Directory Services (NDS) for NT. Attendees then spent two hours learning about Zero Effort Networks (Z.E.N.works), Novell's new desktop management solution.

Next, the Technical Tour featured an in-depth presentation of NetWare 5, which is scheduled to ship in September. The day concluded with a question-and-answer session with Etienne de Klerk of Novell South Africa and Carrie Prewitt of Novell North America, both of whom presented at the Technical Tour.

The tour attracted more than 1,000 attendees in Australia. All attendees received the beta 3 version of NetWare 5, which allowed them to evaluate NetWare 5 first-hand. Attendees responded positively to the Technical Tour, calling it a "great seminar" and "an excellent, informative day."

In August, the Technical Tour continued through Asia, making stops in Mumbai (formerly Bombay), New Delhi, Singapore, Hong Kong, Taiwan, and Seoul.

NORTH AMERICA: INTERCONNECT '98

InterConnect '98 conferences have been making stops in the United States and Canada throughout the year. The remaining InterConnect '98 conferences are listed below:

- St. Louis Conference, September 9–10, 1998
- Minneapolis Conference, September 15–16, 1998
- Phoenix Conference, December 2–3, 1998


The InterConnect '98 conferences feature 33 technical training classes that are divided into five tracks:

- LAN/WAN/enterprise management
- GroupWise management
- Web design
- Network services
- Internet services

Classes cover many different topics. To see a complete list of classes, visit <http://www.novell.com/nui/conf/education>. Three of the more popular classes are listed below:

- **First Class: NetWare 5 Migration and Installation.** This class offers intensive, hands-on instruction, allowing you to try out the new features of NetWare 5 as the instructor explains these features. First Class: NetWare 5 Migration and Installation is limited to 50 participants per conference, so register early to reserve your seat.
- **NDS Inside/Out.** This four-hour class provides detailed information about NDS, including NDS security, utilities, and mechanics. Whether you want to maximize the efficiency of NDS on your company's network or to write NDS code yourself, this course provides the technical information you need.
- **Troubleshooting GroupWise 5x.** This class examines GroupWise 5.x configuration issues, hardware requirements, and troubleshooting tips. This class also features third-party GroupWise utilities that will help you manage your company's GroupWise system.

You can register for the remaining InterConnect '98 conferences on NUI's web site (<http://www.novell.com/interconnect>), or you can call 1-800-228-4NUI or 1-801-228-4500. ●



YOU FEEL THE SAME ABOUT YOUR BOSS AS YOU DO ABE LINCOLN.

(You respect them, but you'd rather not explain networking issues to them.)

As an IT professional, you know that to make the right decisions, you need the latest information on networking and related technologies. But you also know that once you've made those decisions, communicating the "how" and "why" to your superiors can be a daunting task, to say the least.

Executive Decision Seminars and Y2K Teleconference Events

Which is why Novell offers events such as the Executive Decision Seminar Series and "The Year 2000 and Your Network" teleconference. These free events provide you with the information you need to function as an IT professional. But they also provide an easily accessible forum where your superiors can learn how Novell solutions will resolve their key business issues, such as Y2K, network security and productivity. This lets you spend less time explaining and selling up-line, and more time simply doing your job. For more information, or to register for one of these Novell events, call 888.321.4272 or visit us at www.novell.com/boss. Get the information you need, and reacquaint your boss with what's been happening the last four score and seven years.

Novell.

open/net/works

For more information, visit <http://advertise.nwconnection.com>.

A Brand New Car

Matthew Jones

If your car spends more time in the repair shop than on the road, you might want to consider buying another car. The World-Wide Web sites mentioned in this article allow you to conduct research, such as downloading the latest car reviews and performing side-by-side comparisons of the cars you are interested in. You can even purchase a new car or a used car online—avoiding car salespeople completely.

After you have chosen your dream car, you might want to check out this month's network resources and games. You can also read about the hot new products I have found. (See "Product Snapshots" on p. 48.)

WORLD-WIDE WEB SITES

CarPoint (<http://carpoint.msn.com>) claims to be "your complete source for car buying information." Because CarPoint covers so many makes and models and offers so many services, this claim appears to be accurate. At CarPoint, you can get detailed information about nearly every car on the market, from general-purpose sedans, such as the Honda Accord, to high-end sports utility vehicles, such as the AM General Hummer. For example, you can view in-depth pricing reports for any make and model you choose.

In addition to pricing reports, CarPoint offers car reviews, side-by-side comparisons, and safety ratings. CarPoint even offers advice from car experts about leasing and financing, as well as an online payment calculator that helps you determine how much you can afford to pay for your next car.

One of CarPoint's most useful features is its new car-buying service. To use this service, you simply select the car you are interested in, specifying details such as the type of transmission, the interior and exterior colors, and any optional features you want. You then enter your name, telephone number, and e-mail address, and you submit your request. CarPoint forwards this request to a dealer in your area, who contacts you within 48 hours with the lowest price the dealer can offer.

Like CarPoint, AutoSite (<http://www.autosite.com>) generates in-depth pricing reports for new cars. You simply specify the make and the model, and AutoSite displays an easy-to-read pricing report that you can print. You can also print a fact sheet, which includes photographs, technical specifications, performance statistics, crash-test results, warranty information, and insurance rates.

After using CarPoint or AutoSite to find the new or used car you want, you might want to purchase this car online at Auto-By-Tel (<http://www.autobytel.com>), which offers advanced purchasing features. For example, you can register to receive an Auto-By-Tel Mobalist VISA or an Auto-By-Tel Mobalist Re-

wards Card, both of which allow you to earn credit toward purchasing a car through Auto-By-Tel.

If you need financing, you can complete an online application to receive financing from Auto-By-Tel Finance-Lease. And if you need insurance, whether for a new car or for your existing car, you can get a free quote from Auto-By-Tel Insure. Each of these services responds to financing and insurance requests within just one hour.

NETWORK RESOURCES

When you upgrade to NetWare 5, which supports pure IP, you might want to consider migrating your company's network to TCP/IP. To use TCP/IP, however, you must configure each node with an IP address and a subnetmask—a confusing process if you are unfamiliar with TCP/IP. Fortunately, you can download Net3 Group's free IP Subnet Calculator (<http://www.net3group.com/ipcalc.html-ssi>), which helps you determine which IP addresses and subnet masks you can use. (You can also use a Domain Naming System/Dynamic Host Configuration Protocol, or DNS/DHCP, server to take the hassle out of IP addresses and subnet masks. For more information about setting up a DNS/DHCP server, see "Check Out an IP Address With DNS/DHCP Services in NetWare 5," *NetWare Connection*, Aug. 1998, pp. 36–42. You can also download this article from <http://www.nwconnection.com/aug.98/dhcp>.)

The IP Subnet Calculator allows you to access TCP/IP information in several ways: For example, if you entered a subnet, this calculator would display the entire range of IP addresses belonging to that subnet. And if you entered an IP address, the calculator would display the address' hexadecimal equivalent, along with the corresponding subnet mask, subnet ID, network ID, and host ID. You could even view a bitmap showing the location of the class bits, network bits, subnet bits, and host bits within this IP address.

The Internet changes so quickly that keeping up with the latest terminology can be an impossible task. Whenever you encounter an acronym that you can't decipher, you should visit NetLingo (<http://www.netlingo.com>), an online dictionary that specializes in Internet technologies. You can look up a word, browse a list of words, or add a word to the NetLingo database.

In addition, you also launch a "pocket dictionary," which is a JavaScript program that appears in a separate window in your web browser. You can then refer to this dictionary if you stumble across unfamiliar words as you surf the Internet. You can even find a complete list of *emoticons*, which are symbols that users often enter in e-mail messages or chat rooms to express their feelings. :)

E = MC² (Education = Major Cash²)

So you want to be one of the technologically elite—sought after, in demand, popular, cool, making the big bucks? Networking education may be your ticket to the top.

Need to become a NetWare 5 expert? Want to learn how to troubleshoot problems or design an efficient network? Visit or call the Novell Authorized Education Center (NAEC) in your area, or visit the NAEC web link (<http://www.nwconnection.com/naec>).

ARKANSAS

Complete Computing, Inc.
400 West 7th Street
Little Rock, AR 72201
(800) 880-2949, (501) 372-3379
E-mail: Training@complete.com

CALIFORNIA

New Horizons Computer Learning
Center of Bakersfield
5121 Stockdale Hwy, Suite 150
Bakersfield, CA 93309
(805) 397-3606
Contact: JC Coldren
E-mail: jcoldren@nhbakfield.com

New Horizons Computer Learning
Center of San Diego
9191 Towne Centre Drive, Suite 410
San Diego, CA 92122
(619) 558-5555
<http://www.nhsandiego.com>

New Horizons Computer Learning
Center of Santa Ana
1231 E. Dyer Road, Ste. 140
Santa Ana, CA 92705
(714) 556-1220, (310) 348-1144
www.newhorizons.com

CONNECTICUT

IKON Technology Services
Education Services Unit
17 Britton Drive
Bloomfield, CT 06002
(860) 243-1000
www.ikontechnne.com

NextAge, Inc.
401 Merritt 7
Norwalk, CT 06851
(800) 989-8989
Contact: Cal York
E-mail: sales@nextage.com

DELAWARE

Online Consulting, Inc.
300 Delaware Avenue, 14th Floor
Wilmington, DE 19801
(800) 288-8221
Contact: Mike Ward
<http://www.onlc.com>

FLORIDA

TrainX
14411 Commerce Way, Suite 400
Miami Lakes, FL 33016
(305) 822-8010
Contact: Faheeda Ali
E-mail: corp@trainx.com
<http://www.trainx.com>

GEORGIA

New Horizons Computer Learning Center
4053 Lavista Road
Atlanta, GA 30084
(770) 270-4833
Contact: Anne Hall
<http://www.newhorizons-atl.com>

INDIANA

Automated Office Solutions
401 East Indiana Street
Evansville, IN 47711
Contact: Robert G. Parsons
(800) 392-1176
E-mail: rgp@aos-evv.com

MASSACHUSETTS

New Horizons Computer Learning
Center of Boston
5 Old Concord Road
Burlington, MA 01903
(781) 229-9565
Contact: John Zesiger
<http://www.nhboston.com>

Springfield Technical Community College
Center for Business & Technology
One Armory Square
Springfield, MA 01105
(413) 781-1317
<http://cbt.stcc.mass.edu>

MINNESOTA

Benchmark Computer Learning, Inc.
4510 West 77th Street, Suite 210
Minneapolis, MN 55435
(888) Benchmark
<http://www.benchmarklearning.com>

NEW JERSEY

AlphaNet Solutions
7 Ridgedale Avenue
Cedar Knolls, NJ 07927
(800) Alphanet
<http://education.alphanetsolutions.com>

:Track On Technical Education Centers
140 East Ridgewood Avenue
Paramus, NJ 07652
Contact: Valerie Mazza
(201) 986-0900
E-mail: vmazza@trackon.edu

NEW YORK

New Horizons Computer Learning Center
60 Corporate Woods, Suite 300
Rochester, NY 14623
(716) 427-2200
Contact: Kevin Farnsworth
E-mail: nbrelos@nhrochester.com

NORTH CAROLINA

Alphanumeric Systems, Inc.
3801 Wake Forest Road
Raleigh, NC 27609
(919) 781-7575
Contact: Joe Johnson
www.alphanumeric.com

OHIO

Stautzenberger College
5355 Southwyck Blvd.
Toledo, OH 43614
(419) 866-0261
Contact: George Hawes
E-mail: website@stautzen.com

PENNSYLVANIA

Online Consulting, Inc.
15th & Ranstead Sts., 14th Floor
Philadelphia, PA 19102
(800) 288-8221
Contact: Mike Ward
<http://www.onlc.com>

PUERTO RICO

DRC Corp - Training Center
DRC Center Building
1608 Ponce de Leon Ave, Ste. 500
Santurce, PR 00909
(787) 725-3539
Contact: Kathy C. Barreto
E-mail: Kbarreto@drccorp.com

TEXAS

C-TREC
Computer Technology Research & Educ. Center
1700 West Loop South, Ste. 1100
Houston, TX 77027
Contact: Doug Waterman
(713) 871-8411
www.ctrec.com

UTAH

Knowledge Alliance
341 South Main Street, Ste. 406
Salt Lake City, UT 84111
Contact: Melinda Zito-Haase
(801) 322-2211
E-mail: mzito@kalliance.com

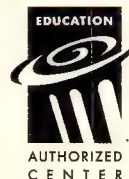
WASHINGTON

Capital Business Machines, Inc.
PO Box 1456
3660 Pacific Avenue
Olympia, WA 98507
Contact: Renae Hackett-Thurman
(360) 491-6000
E-mail: renae@cbm-wa.com

CANADA

Drake Training & Development
#1100, 333-7th Avenue SW
Calgary, AB T2P 2Z1 Canada
(800) 423-9344, (403) 266-8971
Contact: Darlene Laberee
E-mail: dlaberee@draketraining.com

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For more information about being included in the NAEC listing, please call Brian Smith at 1-801-465-4901.

Product Snapshots

When I am looking for the latest computer games, I often find new and interesting products. Product Snapshots gives you a quick overview of the most useful products I have found during the last month. (Please note that these are first-look reviews; I have not conducted exhaustive testing.)

SERVERMAGIC 1.0

ServerMagic 1.0 from PowerQuest Corp. is a NetWare Loadable Module (NLM) from the same company that develops PartitionMagic, a popular solution for managing hard drive partitions. ServerMagic 1.0 introduces a new partitioning capability, allowing you to easily upgrade a NetWare 4 or NetWare 3 server's hard drive by copying the NetWare partition from one hard drive to another. (A future version of ServerMagic will support NetWare 5.)

ServerMagic 1.0 makes upgrading hard drives a snap: With ServerMagic 1.0, you no longer have to back up the NetWare partition on the old hard drive and restore this partition on the new hard drive. Instead, you install the new hard drive, and you use ServerMagic 1.0 to copy the partition to this hard drive.

Because ServerMagic 1.0 allows you to resize both NetWare and DOS partitions on the fly, you can then use ServerMagic 1.0 to increase the size of the NetWare partition so you don't waste any space on the upgraded hard drive. After resizing the NetWare partition, you can use Novell's INSTALL NLM to add volumes to the server if necessary.

ServerMagic 1.0 is compatible with both SCSI and IDE hard drives. In addition, ServerMagic 1.0 uses PowerQuest's Smart-Sector technology, which speeds up the process of copying a NetWare partition by copying only the hard drive sectors that actually contain data.

You can purchase ServerMagic 1.0 through retail channels at the suggested retail price of U.S. \$995. (For a limited time, PowerQuest is offering a mail-in rebate of U.S. \$200.) For more

information about ServerMagic, visit PowerQuest's World-Wide Web site (<http://www.powerquest.com>). You can also call 1-800-379-2566 or 1-801-437-8900.

NET RAPTOR

Net Raptor from JES Hardware Solutions is a network appliance that allows users to share hard drives without requiring you to install a server. Although Net Raptor is not as fast as a server, Net Raptor is a good solution if you need to provide basic file-sharing capabilities.

Net Raptor is also a good solution if you have a heterogeneous network: Net Raptor uses Microsoft's Server Message Block (SMB) technology to support Windows-based workstations, and Net Raptor also uses Network File System (NFS) to support UNIX-based workstations.

Net Raptor contains a 66 MHz RISC processor, a 4-GB Ultra Wide SCSI hard drive, 32 MB of cache memory, and a 10/100 Mbit/s network interface port for Ethernet connections. The Net Raptor case includes two hard drive bays, and you can connect Net Raptor to as many as five external hard drives.

Because Net Raptor includes a Java administration applet, you can configure and manage Net Raptor through any Java-enabled web browser. With the Java administration applet, you can format and partition Net Raptor's hard drives, as well as export these hard drives to the network as shared SMB- or NFS-compliant hard drives. You can also assign users rights to files and directories on Net Raptor. In addition, you can take advantage of several security features, such as restricting a user's access to one or more hard drives based on his or her username or IP address.

You can purchase Net Raptor through retail channels beginning at the suggested retail price of U.S. \$2,500. For more information about Net Raptor, visit JES Hardware Solutions' web site (<http://www.jescdrom.com>). You can also call 1-800-482-1866 or 1-305-597-3980. ●

STANDALONE GAME OF THE MONTH

DX-Ball, which was developed by Michael Welch, is a freeware game that is similar to the classic game, Breakout. Like Breakout, DX-Ball displays a paddle at the bottom of the screen and a set of bricks at the top of the screen, along with a ball that bounces in between. Using the paddle, you must catch the ball as it bounces to the bottom of the screen, directing this ball to hit each brick until you have destroyed all of the bricks. If you succeed in destroying these bricks, you move to the next level, which displays a different configuration of bricks that are even harder to smash.

Basically, the objective of DX-Ball is to keep the ball bouncing as long as you can. If you don't catch the ball, it falls off the screen. You must then use another ball until you don't have any balls left. (You start DX-Ball with three balls.)

When you lose all of these balls, you lose the game. Of course, you lose the balls eventually, so you simply try to beat your own high scores each time.

Although DX-Ball features the basic components of Breakout—a paddle, a ball, and a set of bricks—that is where the similarity between these two games ends. DX-Ball offers a number of advanced features that make it much more addictive than Breakout. (Trust me: I have been playing DX-Ball for weeks, and I still have to tear myself away from the computer!)

For example, DX-Ball includes many types of bricks. In addition to standard bricks that shatter when you hit them, DX-Ball includes bricks that you can explode to destroy surrounding bricks, bricks that you can destroy only with a particular type of ball, and bricks that you must hit several times to destroy.

Some bricks even hide bonus items, which fall to the bottom of the screen when you destroy the bricks. If a blue bonus item falls, you must try to catch this bonus item without losing the ball, because blue bonus items give you special abilities. DX-Ball features 10 types of blue bonus items, which can give your paddle a gun for shooting bricks, turn your ball into a fireball that destroys multiple bricks in a single shot, or add extra balls to your arsenal.

If a red bonus item falls, however, you must try to avoid it, also without losing the ball, because red bonus items make destroying the bricks more difficult. DX-Ball features five types of red bonus items, which can kill your ball, speed up your ball, or cause all of the bricks to begin falling at once. DX-Ball also features three gray bonus items that can be either positive or negative depending on your

circumstances, including a bonus item that expands your paddle, a bonus item that shrinks your paddle, and a bonus item that gives you a second ball to bounce simultaneously.

DX-Ball, which uses Microsoft's DirectX technology, supports Windows NT 4.0, Windows 98, and Windows 95. You can download DX-Ball free from <http://www.clandt.com/dxb/dxball17.exe>. (If you aren't already running DirectX on your workstation, you can download DirectX free from <http://www.microsoft.com/msdownload/directx/dx/enderuser5.0>.) For more information about DX-Ball, visit the official DX-Ball web site (<http://www.clandt.com/dxb>).

NETWORK GAME OF THE MONTH

Quest for Glory 5: Dragon Fire from Sierra On-Line Inc. is the latest game in the popular Quest for Glory series. As Quest for Glory 5 begins, the King of Silmaria has been assassinated, and a new king must be chosen. To prove that you are the best person for the job, you must

complete seven Rites of Rulership. If you are successful, you will become the next King of Silmaria.

You can choose to assume the role of a warrior, a wizard, or a thief. Each of these characters has special skills, which you must consider as you decide which character you want to play: Warriors are more effective in battle, wizards can cast spells, and thieves are stealthy. No matter which character you choose, you can customize the character's skill level, and you can enhance this skill level as you play the game.

Quest for Glory 5 combines a beautifully rendered 3-D world with real-time action. As you travel throughout this world, you are accompanied by a first-class soundtrack, which is one of the best game soundtracks ever. In fact, you would probably expect to hear such a soundtrack in a movie theatre rather than from a computer.

You can play Quest for Glory 5 by yourself or with up to three other people over an Internet connection. Quest for

Glory 5 supports Windows 98, Windows 95, and Macintosh.

You can purchase Quest for Glory 5 through retail channels at the suggested retail price of U.S. \$49.95, or you can order the game online at <http://www.qg5.com/order/order.html>. You can also order a demonstration version of Quest for Glory 5 on CD-ROM for U.S. \$12.95, or you can download this version free from <http://www.qg5.com/demo/demo.html>. (You should be aware that the demonstration version is a 46-MB file, which can take quite a while to download depending on how fast your Internet connection is. If you are using a modem, you might want to purchase the demonstration version on CD-ROM.)

For more information about Quest for Glory 5, visit Sierra On-Line's web site (<http://www.sierra.com>). You can also call 1-800-757-7707 or 1-425-649-9800.

Matthew Jones works for Waterstone Consulting, a technical consulting company based in Chicago, Illinois. You can reach Matthew at matthew@nwconnection.com.



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LearnKey's intra-NetWare 4.11 Bundle
10 videos
ISBN: 290692
Retail Price: \$789.00
Our Price: \$465.00



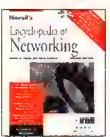
Novell's Guide to TCP/IP and intraNetWare
Drew Heywood
788pp ISBN: 45329
Retail Price: \$49.99
Our Price: \$39.99



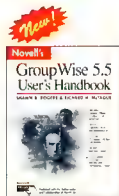
Novell's Guide to Creating intraNetWare Intraneets
Karanjit Siyan
777pp ISBN: 45310
Retail Price: \$39.99
Our Price: \$31.99



Novell's CNA Study Guide for intraNetWare/NetWare 4.11
David James Clarke, IV
969pp ISBN: 45132
Retail Price: \$69.99
Our Price: \$48.99



Novell's Encyclopedia of Networking
Kevin Shafer
1,192pp ISBN: 45116
Retail Price: \$69.99
Our Price: \$55.99



Novell's GroupWise 5.5 User's Handbook
Shawn B. Rogers and Richard H. McTague
300pp ISBN: 45523
Retail Price: \$24.99
Our Price: \$19.99

This reference discusses all the new features of GroupWise 5.5, such as Workflow Manager, Workflow Professional, GroupWisemaging, and GroupWise Publisher. Also included are task-oriented chapters, screenshots, tables, and tips.



Novell's Guide to NetWare for Small Business 4.11
Eric Harper and David L. Gardner
408pp ISBN: 45043
Retail Price: \$34.99
Our Price: \$27.99



Novell's Certified Internet Business Strategist Study Guide
Jim Bowman
456pp ISBN: 45493
Retail Price: \$39.99
Our Price: \$31.99



Novell's Guide to Web Site Management
Jim Bowman
849pp ISBN: 45299
Retail Price: \$59.99
Our Price: \$41.99



Novell's Introduction to Networking
Cheryl C. Currid
328pp ISBN: 45256
Retail Price: \$19.99
Our Price: \$13.99



Novell's Guide to BorderManager
J.D. Marymee and Sandy Stevens
350pp ISBN: 4540X
Retail Price: \$49.99
Our Price: \$39.99



Novell's Internet Plumbing Handbook
Peter Rybaczyk
311pp ISBN: 4537X
Retail Price: \$34.99
Our Price: \$24.49



How To 2000
Raytheon Systems
656pp ISBN: 31018
Retail Price: \$49.99
Our Price: \$39.99

This book tackles the year 2000 issue from all sides. It contains a complete description of compliance phases, standards for tracking progress, quality-assurance guidelines, project monitoring, problem definition, and a full review of third-party tools.



Novell's Certified Web Designer Study Guide
Jim Bowman
600pp ISBN: 45485
Retail Price: \$49.99
Our Price: \$39.99



Novell's CNE Study Set for intraNetWare/NetWare 4.11
David James Clarke, IV
2,532pp ISBN: 45337
Retail Price: \$148.99
Our Price: \$104.29



Novell's Dictionary of Networking
Kevin Shafer
640pp ISBN: 45280
Retail Price: \$24.99
Our Price: \$19.99



Novell's Guide to LAN/WAN Analysis: IPX/SPX
Laura A. Chappell
874pp ISBN: 45086
Retail Price: \$59.99
Our Price: \$47.99



Novell's GroupWise 5 User's Handbook
Shawn B. Rogers and Richard H. McTague
260pp ISBN: 45094
Retail Price: \$24.99
Our Price: \$19.99

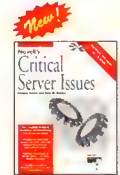


Novell's Introduction to intraNetWare
Kelley J.P. Lindberg
416pp ISBN: 45302
Retail Price: \$39.99
Our Price: \$31.99

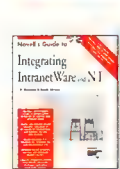


HTML 4 Bible
Bryan Pfaffenberger and Alexis D. Gutzman
1000pp ISBN: 32200
Retail Price: \$49.99
Our Price: \$39.99

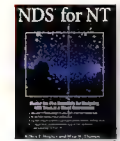
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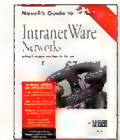
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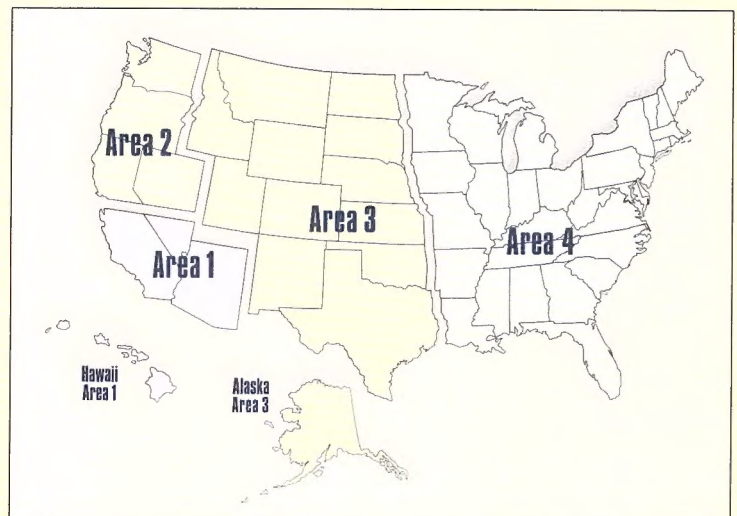
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